Fourth Annual

Electric Energy Forum

ELECTRICITY, EDUCATION AND THE ENVIRONMENT

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SUMMARY

B. C. Hydro's Fourth Annual Electric Energy Forum was held in Victoria, B. C. on April 16 to 18, 1991, in warm spring sunshine. The theme of the 1991 Electric Energy Forum was 'Electricity, Education and the Environment.' Nearly 300 delegates, comprising educators, scientists, environmental groups representatives, government officials, curriculum planners, utility managers and members of the public, gathered at the new Victoria Conference Centre for this two day conference.

Delegates were welcomed by Hydro's Chairman, Mr. Robert Wyman; by Mr. David Turner, Mayor of Victoria, and by representatives of the sponsoring Government Ministries of Education, the Environment, and Energy, Mines and Petroleum Resources. A moment of silence was held in memory of the late Energy Minister, Dr. Jack Davis, who had passed away shortly before the opening of the Forum.

Ten electrically–powered automobiles were on display at the Forum, including two vehicles which offered delegates complimentary electric car rides around the streets of Victoria. The electric cars ranged from a 1912 Detroit Electric to battery-powered conversions of modern compact cars. The electric car display was arranged by members of the Vancouver Electric Vehicle Association.

As one of Tuesday's Forum activities, a 'Design Challenge' was sponsored by B. C. Hydro and the Ministry of Advanced Education and Job Training, Science and Technology. More than 75 students from 18 schools in Victoria and the surrounding area as far away as Duncan were attracted to the competition. With emphasis on the 'fun' side of science, the students were challenged to put their creativity and imagination to the test, designing and constructing projects using a prescribed set of materials within a limited amount of time. The successful Design Challenge concluded with an Awards luncheon for all participants.

A Power Smart Show was held at the same time as the Fourth Annual Electric Energy Forum in the upper levels of the Victoria Conference Centre. The Power Smart Show, open to the public, combined a B.C. Hydro demonstration of efficient lamps and motors conducted by Mr. Shell Busey, and a trade show consisting of a number of booths displaying 'Quality Plus' home construction components, hydrogen fuel cells, and other Power Smart technology.

In keeping with the science education aspects of the theme of this year's Forum, teams from Science World came to the Conference Centre to present their entertaining 'science' shows during the Forum. These shows were open to the public.

The keynote address to commence the Forum was given on Tuesday evening by Dr. Frank King, former chief executive of the XV Winter Olympic Games in Calgary. His topic, 'What On Earth Is Going Wrong?' addressed the major unresolved environmental and overpopulation problems facing the world. He pointed out the world's population will have grown from one billion people in 1930 to a projected eight billion by the year 2025. Ninety–four percent of the children now being born are born into the Third World. People in developed countries represent 20 percent of the population but now use 80 percent of the world's resources annually. There are now over 400 million automobiles in the world, each

emitting more than its own weight in carbon dioxide each year. He noted that world consumption of fossil fuels is up 30-fold since 1900.

He concluded by stating that our present rate of consumption of non-renewable resources cannot be allowed to continue. Radical changes in our lifestyles will have to be made by all Canadians before we can begin to achieve the 'sustainable development' advocated by the United Nations' Brundtland Commission. He urged us all to think long and hard about these issues.

Following the keynote address, the delegates were treated to an International Dance display, performed by students of the Lester B. Pearson College of the Pacific near Victoria.

At the beginning of the Wednesday session, delegates were welcomed by Hydro Chairman Bob Wyman and Conference Chairman Einar Field, Vice-President of Human Resources, B. C. Hydro. Morning sessions included a description of Hydro's Power Smart Program by Derek Henriques; 'Opportunities in Science and Engineering' by Janet Halliwell of the Science Council of Canada; 'Developing an Environmental Awareness Through Education' by Prof. Martin Hocking of the University of Victoria; and 'Bringing Science to Life' by Lon Mandrake, Past President of the B. C. Science Teachers' Association. The morning session concluded with a panel discussion on 'Issues in Education and Public Expectations,' led by Dr. David Scott, Professor of Mechanical Engineering, University of Victoria, and with the above speakers as panellists

A luncheon address was given by John Allan, Deputy Minister of Energy, Mines and Petroleum Resources, whose topic was 'Power and Posterity'.

The Wednesday afternoon session was led off by a presentation by Dr. Leonard Sagan, Program Manager, Radiation Studies, Environmental Division of the Electric Power Research Institute of Palo Alto, California. His topic was 'EMF Danger: Fact or Fiction?' Dr. Sagan reviewed some of the recent somewhat contradictory studies of the possible statistical correlation between childhood leukemia cases and exposure to electromagnetic fields.

The initial studies related the incidence of childhood leukemia to a descriptor called 'wiring codes', which were subjective categories determined from a visual inspection of transmission lines and a judgement of the amount of current they might be carrying as one of four codes. This code, coupled with the distance from the transmission line to the home, showed an apparent correlation with the incidence of childhood cancers.

Subsequent studies attempted to measure the actual magnetic fields in each home studied, and to relate this to the incidence of cancers. No relationship was found.

A third set of studies, recently completed by the Electric Power Research Institute at the University of Southern California, recorded wire codes and measurements of magnetic field strengths at 15-second intervals over a 24 to 72-hour period, and attempted to relate these data to the incidence of childhood cancer. Again, a relationship between wire codes and cancer was indicated, but no correlation with magnetic field levels was found. Children in the highest exposure homes, as indicated by the wire code, had double the risk of leukemia as children in low exposure homes.

What is more surprising is that a relation was found between the use of 13 common household appliances and childhood cancer that was even more pronounced than for wire codes. For electric hair dryers and black and white TVs, the differences were statistically significant.

It is not clear what these studies are telling us. It may be that magnetic fields near transmission lines have nothing whatever to do with the association with wire codes and cancer, and that something else, some other factor, whether it be air pollution, pesticides or cigarette smoking or who knows what, may be the cause of cancer. Very little is known about the causes of childhood cancer. And so the jury is still out. Further studies are currently under way.

Dr. Sagan concluded by saying that it's still too early to tell what the relation between wire codes and childhood cancer can mean.

The second speaker on Wednesday afternoon was Henry Morgan, a member of the South Coast Air Quality Management District Board, of Greater Los Angeles, California. Mr. Morgan described the automobile emission problems in southern California that led the City of Los Ange-

les to order 10,000 electric vehicles for municipal use in order to cut down on air pollution. Prototype vans are now being designed in Detroit to meet this major order.

The next three speakers on the Wednesday afternoon session were Hydro's Ms. Tazeem Nathoo, speaking on 'Partnerships in Education; Peter Ostergaard, Assistant Deputy Minister, Ministry of Energy, Mines and Petroleum Resources, speaking on 'New Directions in B. C. Energy Policy For the '90s,' and Warren Bell, Director of the Energy Management Branch, Ministry of Energy, Mines and Petroleum Resources, speaking on 'Government Policy on Energy Efficiency'.

The final event in the Wednesday afternoon program was an 80-minute workshop session in which all the Forum delegates were invited to participate in helping B. C. Hydro focus its Power Smart advertising and promotional efforts most effectively in future.

On Wednesday evening, the Lester B. Pearson College students returned to give the Forum delegates a thrilling international choral and folk-dancing presentation.

Another full day of Forum activities followed on Thursday, April 18. The initial speaker was Marge Qualls, Director of Consumer Affairs, Puget Sound Power and Light Company, Seattle, speaking on 'Business and Education: An Investment in Tomorrow'. She was followed by Chris Boatman, Vice–President of Corporate and Environmental Affairs, B. C. Hydro, who spoke on 'Communicating With the Public in the '90s.' A three-hour continuation of the break-out workshop sessions followed, involving the delegates in brainstorming new methods of sending the Power Smart conservation message to Hydro's customers.

While the delegates were in the workshop sessions, a group of nearly one hundred Grade 11 and 12 students from southern Vancouver Island were occupied in a parallel workshop session organized as part of Hydro's 'Partners in Education' program by coordinator Barbara West. The students were asked to discuss the same workshop material as the delegates.

Lunch was followed by a brief address from the Hon. David Mercier, B.C.'s newly-appointed Minister of the Environment, whose talk was entitled 'What We Owe Our Children'. A presentation to representatives of Pearson College for their excellent evening programs was made by B.C. Hydro to conclude the luncheon.

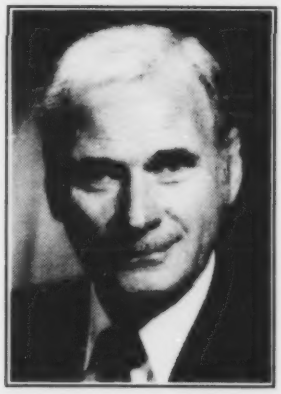
The Thursday afternoon session began with Senator Michael Kirby, Vice–President of Goldfarb Consultants, who reported on 'Changing Public Attitudes to Education.' This was followed by a preliminary analysis and summary of the delegates' views in the morning discussion sessions, presented by Mr. Jim Savage, Hydro's consultant for the workshops. Chris Kask, a Grade 12 student from Victoria Secondary school, presented the views of the students in the 'Partners in Education' workshops to the Forum delegates. Chairman Einar Field thanked both the delegates and the students for their suggestions and promised that Hydro will play close attention to their views when designing future Power Smart energy-saving programs.

The final event on the Forum program was a panel discussion 'Education Challenges for the Future,' moderated by Michael Kirby. Panellists were Norm Gilberstad, Coordinator for Sciences, Curriculum Development Branch, Ministry of Education; Dr. Walter Hardwick, Professor of Geography, UBC; Mr. Matt Hassen, Director of Personnel, Burnaby School Board; Dr. Milt McClaren, Associate Professor of Education, Simon Fraser University; and Marge Qualls, Puget Sound Power & Light Company. A lively discussion of the problems of introducing environmental and Power Smart concepts into the school curriculum followed. Their remarks provoked a great many written questions from the audience.

In his closing remarks, Hydro's Bob Wyman thanked the delegates for attending and participating in the Fourth Annual Electric Energy Forum, and invited them to plan to attend the Fifth Annual Electric Energy Forum, which will be held in Victoria, from Sunday, May 10 to Tuesday May 12, 1992.

INTRODUCTION
AND
KEYNOTE ADDRESS

Your Conference Chairman



Einar Field

Einar Field is Vice–President of Human Resources at B.C. Hydro. Mr. Field was educated in his native Norway. After gaining experience in the private sector, he joined B.C. Hydro's predecessor, the B.C. Electric, in 1957. Mr. Field held positions in Distribution and Customer Services in northern and central B.C. before being appointed to his present position. Einar Field is a member of a number of boards, including the Technical Service Council and the Conference Board. He is very active in outdoor sports, including hiking and whitewater canoeing.

FOURTH ANNUAL ELECTRIC ENERGY FORUM
Official Opening and Introductory Remarks

Introduction of Robert Wyman by Einar Field

Good evening Ladies and Gentlemen. My name is Einar Field and I am going to be your Chairman for Hydro's Fourth Annual Electric Energy Forum.

I would like to open with a few housekeeping items. In your registrant's packages, for those who have received them, there are a number of question slips. If you have a question for the speaker during his presentation, please write it down and pass it to one of the runners who will be circulating in the aisles to collect the questions for me; it is my task to present the questions to the speaker. We will follow the same format throughout the plenary sessions at the Forum. This procedure will allow us to present clearly each question for the benefit of all of the people here tonight. If there are any questions which we are not able to answer with this process, we will endeavour to respond to them later in the printed Forum Proceedings. I will have an opportunity to say a few words at the opening of the program tomorrow morning. It is now my pleasure to introduce Mr. Robert Wyman, the Chairman and Chief Executive Officer of B.C. Hydro.

Official Opening by Bob Wyman, Chairman and CEO of B.C. Hydro

Thank you very much, Einar, and welcome to the Fourth Annual Electric Energy Forum. I would like to dedicate this Forum to the memory of the late Honourable Jack Davis, who for many years was the Minister responsible for B.C. Hydro in the B.C. Cabinet. I will have more to say about Jack during my remarks tomorrow morning, but for now I would just ask that we all observe a moment of silence in honour of this great British Columbian.

(Delegates rose and observed a moment of silence.)

Now I would like to recognize the representatives of the four provincial government ministries that are co-sponsoring this Forum with us this year, and I ask that you withhold any applause until these introductions are complete: from the Ministry of Energy, Mines and Petroleum Resources, from the Ministry of Environment, from the Ministry of Advanced Education and Job Training, Science and Technology, and from the Ministry of Education, Dr. Barry Carbol. Dr. Carbol is the executive director of the Ministry of Education's programs division, and he will add a few words on behalf of the Ministry.

Introductory Remarks by Dr. Barry Carbol, Ministry of Education

Thank you, Chairman Wyman, and good evening, ladies and gentlemen. On behalf of the Minister of Education, the Honourable Stan Hagen and the Government of British Columbia, I would like to welcome you all to B.C. Hydro's Fourth Annual Electric Energy Forum, and especially those of you who have travelled from outside the province to be here.

I was told that it would be remiss of me if I didn't take a few moments to put in a plug for education, so I'm going to do that first.

It is particularly fitting that this year's theme, 'Energy, Education and the Environment' comes at a time when the Government of British Columbia is responding to the expressed need of many people in our province for reform in our school system. The Government's response to the Sullivan Royal Commission has included the legislation for a new School Act and the production of the document 'Year 2000: A Framework for Learning'. A copy of 'Year 2000 Highlights' has been included as part of your registration packet.

The Minister would like me to emphasize

two aspects of these 'Year 2000' initiatives as they relate to this year's Forum. First, there is an increasing need and desire for educators to work more closely with people in the community, and the business community in particular. These partnerships serve to widen the resource circle for both teachers and learners and provide career education opportunities for students. Partnerships are, in part, an acknowledgement of the willingness of the business community to take a more active role in the education of our young people.

A second element of the 'Year 2000' is the greater emphasis on issues and universal themes as integral components in the development of new curriculum. Energy and the environment are two important themes of the day not only in their own right but, also, as this year's Forum suggests, in their intimate linkage with each other. It is the integrative nature of environment that can incorporate energy conservation as an issue. It is this kind of integration that can be encouraged in our schools, and be characteristic of 'Year 2000' instructional practice. Through an exploration of themes and issues, senior students, in particular, can develop the attitudes, knowledge and skills, especially those thinking, decision-making, and problem-solving skills needed and expected of an educated and productive citizen.

The Ministry of Education is pleased to be a co-sponsor of this year's Forum and wishes its organizers every success. Thank you, B.C. Hydro, for the invitation to participate.

Response by Bob Wyman: Thank you very much, Dr. Carbol.

Introduction of Mayor David Turner by Bob Wyman: Now I would like to introduce the Mayor of this beautiful city where we are holding our Forum, His Worship, the Mayor of Victoria, David Turner. Mayor Turner would like to add a few remarks of welcome.

Welcome by the Mayor of Victoria, Mr. David Turner: Thank you very much, Mr. Wyman. The City of Victoria is proud to be the host location for this very important conference, and I think B.C. Hydro has shown very good taste in choosing to come here. If all of Hydro's decisions under your administration are as sensible as that one, then you will be doing very well indeed.

We in Victoria are very appreciative of our beautiful natural surroundings, and I am glad to see that once again you will be stressing the environment as a key part of your deliberations. We all recognize that B.C. Hydro has a job to do in providing us with electric service, but we are pleased with the emphasis that you are placing at the same time on the preservation of our natural resources. The other main element in your theme is education, and again we are glad that you are recognizing the importance of learning about the connections between our material needs and their environmental implications. I think that these Forums are an excellent way for us all to increase our understanding of these matters.

I know that you have a lot of work to do during the next couple of days, but I also notice that your Forum organizers have left you the evenings free. You will find many interesting attractions here, and I think there are some brochures in your registration kits that will tell you more about them. And you are always welcome to come back to Victoria for your vacations!

Introduction of David Strong by Bob Wyman: Thank you, Mr. Mayor. We have with us tonight another distinguished guest, the president of the University of Victoria, David Strong. The University is one of our biggest customers in the Victoria area, with a Hydro bill of more than a million dollars a year. And they would like to cut that down. And that would be fine with us, because we are all in favour of saving electricity wherever that can be achieved.

Last year the University entered into an energy efficiency agreement with us. Under that agreement we will help them design their new buildings with the maximum energy efficiency built in, and to modify their existing buildings to save electricity there too.

Just the other day it was announced that Power Smart will be a co-sponsor of the Commonwealth Games here in 1994. Well, the athlete's village will be at the University of Victoria, and after the Games are completed the village buildings will become student residences. And of course they will be energy efficient.

Our agreement with the University also includes an information program for their employees and students. This will help us create more awareness among your people who will be the

future leaders of business, education and industry in this province.

So now, if President Strong would be good enough to come forward, I would like to present him with this framed copy of our energy efficiency agreement.

Keynote Address

What on Earth is Going Wrong ?

Frank King

President and Chief Executive Officer
Metropolitan Investment Corporation

Introduction of Keynote Speaker by Bob Wyman, Chairman and CEO, B.C. Hydro

Now I would like to introduce our feature speaker for this evening, Dr. Frank King.

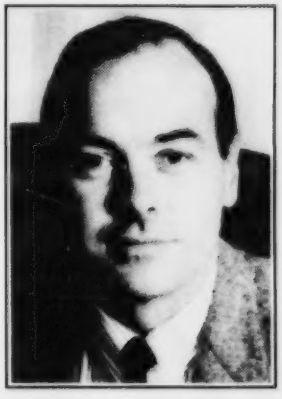
Frank is President and Chief Executive Officer of Metropolitan Investment Corporation and a director of several corporations, both private and public. He is also Executive in Residence with the Faculty of Management at the University of Alberta, but he is perhaps best known for his work with the Olympic Games.

Frank was Chief Executive of the Fifteenth Olympic Games in Calgary and during his Olympic years he received many awards, among them an honourary doctorate from the University of Calgary and being made an Officer of the Order of Canada. He has completed a book on the valuable lessons learned from the Olympic Games and has been appointed by the International Olympic Committee to the Commission for the Organization of Future Olympic Games.

My notes describe Frank as an excellent speaker in a wide range of fields including motivation, business, sport and environmental awareness. So I am expecting that he will get us off to a running start by motivating us to make environmental awareness our business as he discusses communication, education and the environment.

Ladies and gentlemen, it gives me great pleasure to present your keynote speaker, Dr. Frank King.

What on Earth is Going Wrong?



Thank you very much, Mr. Chairman, and good evening, distinguished guests.

I'm very glad to be back here in the city of Victoria, the host city for the 1994 Commonwealth Games. With my background in the Olympics you can understand that I have a great affinity for what you have done, what you're doing and what you're going to do. I wish in another time and some other place that we would have an evening together so that we could talk more about the Games.

I wanted to add my warm words of welcome to those visitors to Victoria and to this conference, an important conference. I would like to also thank the sponsors in advance for making sure that this kind of subject is up for discussion. B.C. Hydro and the Government of British Columbia are taking a very responsible role in bringing you together here and I know you would want me to thank them, and someone will be doing that, I'm sure, more generously at the end of the Forum that we're about to embark on.

Well, now I would like to tell you what my mission was as I was invited to come to speak here. Apparently, you are all here to take a look at the use of public education to reduce the use of energy and to improve the environment.

So I would ask you first of all to answer this question of yourself; if the earth had only ten years left to live, what would you do differently?

Well, I want to help each of you tonight to

reach a decision on that particular question. In order to do that I'm going to tell you a fairy tale.

Our story starts in the city of London, England in 1980, where two rock stars from the stage show 'Time' are suddenly snatched from the earth and taken 20 million light years to the Andromeda Galaxy at the centre of the universe. These two earthlings have been transported to Andromeda to be put on trial before Akash, the Time Lord of the Universe. Now that earthlings were beginning to explore space, and in view of their poor record of managing their own planet, the prosecution wants the earth destroyed before it pollutes the whole universe. "Look at it", cries the prosecutor, "this planet, as you're seeing it now:

Ever since they first began they've fought
from war to war,
Making bigger and bigger bombs to open
wide death's door.
It's hell on earth, two great wars, perhaps a
third, they don't see eye to eye.
Civilized, they say they've become, and still
their people die!
Our universe, it does not need them to bring
their hypocrisy here.
But now they're walking on the moon, the
threat's become a fear.
They've got suicide, war, starvation and
pollution; homicide, greed and lack of
evolution.
They've got every sin you could ever devise; pain, strife, disease, and a population
rise!
We've given them time to lift themselves but
they don't seem to try. They've children
starving and all they do is sigh.
Now they're heading into space with morals
that make me cry.
That's the prosecution's case; the earth will
have to die."

Lord Akash says, "These facts do not inspire much confidence, do they?".

The earthlings say, "What on earth has gone wrong? What are we to do? All the mistakes we've made must be faced today. It's not easy knowing where to start while the world we love tears itself apart. Time will teach us well. Give us more time. Are we too young to know or too old to change?"

Lord Akash answers, "You must first identify your problem. I will give you the key and with this knowledge comes the responsibility for sharing it. Throughout the universe there is order, in the movement of planets, in nature and in the functioning of the human mind. Your life is an expression of your mind. You are a creator of your own universe, for as a human being you are free to will whatever state of being you desire through the use of your thoughts and words and actions. There is great power there. It can be a blessing or a curse. It's entirely up to you. For the quality of your life is brought about by the quality of your thinking. Think about that."

Akash continues, "Thoughts produce actions. Look at what you are thinking. See the pettiness and the envy and the greed and the fear and all the other attitudes that cause you pain and discomfort. Realize that the one thing you have control over is your attitude. See the effect that it has on those around you. Your words carry with them chain reactions like a stone that is thrown into a pond.

If your thinking is in order, your words will flow directly from the heart, creating ripples of love. If you truly want to change the world, my friends, you must change your thinking. Reason is your greatest tool. It creates an atmosphere of understanding which leads to caring. Choose your words with care. Go forth with love."

The earthlings: "It's in every one of us to be wise. Give us time and we will improve by and by."

Akash says, "But can we wait for you? Dare we wait for you?"

Lord Akash decides to give the earth until the year 2000 to prove that it can manage the greatest project in human history. The earth has only 20 years to save itself from destruction by the lord of the universe. So the fate of the earth is left hanging in the balance as the universe waits for a sure sign that change is possible.

Immediately, the rock stars return to earth and people in every country set out to gather facts which could be used to convince the leaders and all the people that they must change the way things are on earth.

A team of Canadians begins by compiling some astonishing facts about the earth and the

way we abuse it.

They find that if the earth were the size of an apple then the atmosphere would be less than the thickness of the apple skin. The atmosphere rotates around the world 40 times every year, so boundaries don't count when the air is polluted.

The ozone layer is getting thinner. A crucial one percent is being lost every ten years.

Acid rain has impeded the growth of trees and reduced agricultural production in 25 % of North America.

There are 400 million automobiles in the world. Each one emits more than its own weight in carbon each year.

About 50 percent of all urban space in Canada and the United States is dedicated to the automobile; driveways, roads, freeways, parking lots. The Canadian team find that if the world were the size of a basketball, then all the water on earth would amount to less than one cup and if the world were a basketball, all the water fit for human consumption would be only one large drop, a mere 1/100th of one percent.

Yet worldwide water use doubled between 1940 and 1980 and is expected to double again by the year 2000. Canadians and Americans use enough water to provide the equivalent of 2,000 toilet flushes per person every day. Twenty-five percent of all eastern Canadian and US lakes and rivers cannot support full marine life.

Then they find that the land covers only 30 percent of this planet. In Brazil, they clear 2.3 million hectares per year of the rain forest. This is equivalent to one football field every two seconds, every day, all day long. If the clearing continues at this rate the Brazilian rain forest will be gone in 30 years, and ladies and gentlemen, nothing grows there after only three years, in spite of futile attempts by humans to cultivate the remaining soil.

Worldwide, we lose 40 billion tonnes of soil each year and 27 million hectares are taken out of agricultural production annually for urban use, 50 percent of which is used for automobiles.

Americans produce more than 300,000 tonnes of toxic waste each day. Each Canadian produces one tonne of solid waste per year. Each year Canadians throw away 24 million tires, 175 million spray cans, 300 million litres of waste oil and 550 million pounds of soiled diapers.

The Americans throw away roughly ten times as much. Eighty-two percent of all Canadian waste goes into landfills. It is not a pretty sight.

But there is some good news in the story. The Canadians find out that in Japan only 28 percent of all waste goes into landfills.

They found that there is a serious population explosion. The world population has increased from 2.5 billion in 1950 to 5.2 billion in 1990. The six–billionth person is expected to be born in 1998 and the eight-billionth in 2025. Almost 100 million will be born each year during the next decade, and 95 percent of them are in developing countries.

People in developed countries account for 20 percent of the population but consume 80 percent of the world's resources.

People in the world currently unleash 15 million tonnes of CO_2 every year, up tenfold since 1900. Americans and Canadians lead the world in CO_2 emissions per capita. World economic activity is up 20-fold since 1900 but world consumption of fossil fuels is up 30-fold in the same period. Our annual consumption of fossil fuels is now equivalent to one billion years of nature's production.

Global military expenditures are $35,000 US per second and still growing. In many countries military expenditures pre-empt scarce resources and diminish development prospects, thus creating resentment and conflict.

By the year 2000, nearly 42 percent of the world's population will be less than 25 years of age. Many of these individuals will depend largely on others for food, education, clothing and shelter. By the year 2025, 57 percent of the world's population will live in urban centres, compared to 34 percent currently.

While realizing the many problems facing earth, the leaders of the world in the 1980s began to cooperate with each other to find solutions to these problems.

Important international agreements were reached to cut the use of CFCs and to reduce the emission of CO_2.

The United Nations established the World Commission on Environment and Development, the Brundtland Commission. The urgent need for this work was demonstrated by a series of environmental tragedies which occurred in the brief time taken to prepare this report. In just 900 days:

- A drought triggered an environmental crisis in Africa, killing over 2,000 people and blinding or injuring 200,000 more.
- A leak from a pesticide factory in Bhopal killed over 2,000 people, and blinded or injured 2,000 more.
- Liquid gas tanks exploded in Mexico City, killing 1,000 and leaving thousands more homeless.
- A nuclear explosion at Chernobyl spread nuclear fallout across Europe, increasing the risk of future human cancer.
- Chemicals leaked into the Rhone River during a warehouse fire in Switzerland, killing millions of fish and threatening drinking water in the region.
- An estimated 60 million people died of diseases related to unsafe drinking water and malnutrition. Most of the victims were children.

Akash was right, the earthlings concluded, "These facts do not inspire confidence. Do they?"

Then, in 1991, some of the most concerned earthlings travelled back to Andromeda to seek help, for even though much progress had been made they were afraid it was not enough. They visited Lord Akash and said to him, "We know that you are wise and that you have seen how the universe has survived over thousands of light years. We have only nine years left. Please tell us, what on earth is going wrong, and tell us how to make it right".

Akash thought about this briefly and responded, "There are those among you with political agendas and environmental causes which are too radical for practical purposes. The positions of many such groups often lack acumen and accuracy. On the other hand, there are governments and media who often are guilty of misinterpretation, exaggeration and unjustified extrapolation of data. This has confused the people and slowed real progress".

"Although environmentalism in 1991 is riding the crest of a wave of popular public and political opinion that popularity will soon decline unless you base all your actions on sound science, education and economic follow-through. This is what sustainable development is all about! This is how the universe has survived".

"As business leaders, scientists and educators you have a responsibility to become more involved in local educational and environmental issues that threaten the future life on earth, the future of landfills, the production of energy from renewable resources, the loss of productive soil, the exponential growth of human population, the safety of drinking water, the production of nuclear weapons, the destruction of many life species and the control of carbon dioxide emissions, to name a few".

"The time is past for you to react and cure past mistakes. Today you must teach people to anticipate and prevent these kinds of problems. From now on you must be part of the solution, because you are part of the problem. You all must do your part. If you expect life on earth to survive you must begin now to teach the young about the earth, natural science and the effect of humans on it. But even before this new generation of informed environmentalists arrive, corrective action must be taken".

"You must move beyond your present position to a new position where environmental safety and public health are a given, not an afterthought. You must select your best people to start work immediately on a mission to save the earth. You realize now that this is the greatest challenge that life on earth has ever faced".

"Your mission, should you decide to accept it, is to: **Build a future for your planet which is more prosperous, more just, more secure. You must develop a new era of economic growth, only this time it must be based on policies and public attitudes that expand the environmental resource base**.

"Your mission is absolutely essential to relieve the great poverty that is deepening today in much of the developing world. There is a human population explosion. The poor countries are expanding rapidly. There are already too many

poor, unproductive people living well beneath acceptable human standards. The need for organized development is not critical. The means of support is limited. Without access to adequate water and land there will be mass migrations and environmental degradation. If you fail the earth will have to be destroyed before it contaminates the universe. The universe is counting on you but time is working against you. The future depends on you."

So the earthlings returned to earth, to a meeting of business managers, scientists and educators who came together in 1991 in Victoria to decide if they were ready to accept the challenge of saving the earth. "The challenge is clear," they said to themselves, 'If we are to succeed, we all need to play a role, knowing that we can make wise decisions when presented with the facts. We will have to introduce changes, new and better ways of doing things. These changes will have many enemies. At first, there will be far more questions than answers."

"Painful choices will have to be made. Thus, in the final analysis, sustainable development must rest on the political will of the people. We must act now to take control of our own destiny."

They knew the job facing them was complex and difficult so they focused urgent action on the eight most important issues.

• The first was population and human resources.

The population is growing at rates that cannot be sustained by available environmental resources, at rates that are outstripping any reasonable expectations of improvements in health care, food, security or energy supplies. Urgent steps are needed to limit extreme rates of population growth. This is the first and most important step in the education process

• The second focus was on food security.

Global agriculture has the potential to grow enough food for all but food is not often available where it is needed. Production in industrialized countries has usually been highly subsidized, encouraging the overuse of soil and chemicals and resulting in degradation of the countryside. Much of this effort has produced surpluses which have been sent at concessional rates to the developing world where it has undermined the farming policies of recipient nations. Developing nations need education, training and incentive systems to encourage production, especially of food crops.

• The third focus was species and ecosystems.

The planet species are under stress. There is growing scientific consensus that species are disappearing at rates never before witnessed on the planet. The diversity of the species is necessary for the normal functioning of the world. The genetic material in wild species contributes billions of dollars yearly to the world in terms of improved crops, new drugs and medicines and raw materials for industry. There is still time to halt the process of disappearing species.

• The fourth focus was energy.

To bring developing countries' energy use up to the industrialized countries' level by the year 2025 would require increasing the present global energy by a factor of five. The planetary ecosystem could not stand this, especially if the increases were based on non-renewable fossil fuels. Threats of a global warming and acidification of the environment most probably rule out even a doubling of the energy use based on present mixes of primary sources. Any new era of economic growth must therefore be less energy-intensive than growth in the past.

Energy-efficient policies must be at the cutting edge of national energy strategies for sustainable development and there is much scope for improvement in this direction. **A safe, environmentally sound and economically viable energy pathway that will sustain human progress into the distant future is clearly imperative. It is also possible, but it will require new dimensions of political will and institutional cooperation to achieve it.**

• The fifth focus dealt with industry.

The world manufactures seven times more goods today than it did as recently as 1950. Given population growth rates, a five to tenfold increase in manufacturing output

will be needed just to raise developing world consumption of manufactured goods to industrialized world levels. This will take more energy and more resources. But the globe can't give much more and the globe can't take much more, so we will all have to produce more with less.

• **The sixth focus was on urbanization.** The 21st century will be largely an urban world. Few cities in the developing world have the power, the resources and the trained personnel to provide their rapidly-growing populations with land, services and facilities needed for an adequate human life. The result is mushrooming illegal settlements with primitive facilities, increasing over-crowding and rampant disease, linked to an unhealthy environment.

Many cities in industrial countries also face problems; deteriorating infrastructure, environmental degradation, inner city decay and neighbourhood collapse. **Industrialization, energy and food development strategies must be integrated with new urban development strategies to ensure synergy.**

• **The seventh focus covered the global economy.** The sustainability of the ecosystem on which the global economy depends must be guaranteed. The economic partners must be satisfied that the basis of exchange is equitable. For many developing nations neither condition is met. Widespread co-operation on development of an effective global economy must be achieved.

For example, governments and international agencies should assess the cost-effectiveness in terms of achieving security of money spent on armaments compared to money spent on reducing poverty and restoring a ravaged environment. Globally, military expenditures are about one trillion US dollars per year and is growing.

• **The final focus was for the Commons.** The shared ecosystems including the oceans, Antarctica and outer space raise particular problems that require expertise and sound management. The international community should design and implement a regime for management for the global commons that ensures that they will remain a peaceful place for the benefit of all.

"From 1991 on, great progress was made in each of the focus areas. At the end of the 1990s, important changes were seen on earth as it hurtled towards the 21st century.

Finally, the time came when the people had to provide evidence to Akash that what had been achieved was enough to save the earth. So on the eve of the new millennium the earthlings presented their case to the Lord of the Universe. Let's listen to their evidence.

Even though coal, oil and gas still provide more than half of earth's energy needs in the 2000s, more efficient power plants and industrial processes have reduced the impact to acceptable levels.

The use of nuclear energy has declined and will eventually disappear or be replaced by nuclear fusion and other new technologies. More importantly, nuclear weapons have been totally eliminated on earth.

Wind power is now a commercially competitive source of power, providing up to ten percent of the world's power needs. The use of geothermal power is now three times what it was in 1980. Solar thermal power plants with natural gas backup (for rainy days) have now become the second leading new power source, surpassed only by solar photovoltaic power which converts the sun's radiation directly into electricity using semi-conductors.

Hydro power has also increased its role but has now reached its limitation. Equally efficient tidal power projects are now on the drawing boards. Biomass sources such as wood, agricultural waste and garbage are now used to fuel sustainable energy plants throughout the world. We have learned that these sources do not contribute to CO_2 buildup when new trees are planted to replace them.

Co-generation of power and heat is now commonplace. Power plants that burn methane recovered from landfills have been effective in slowing global warming. Since methane has 25 times the greenhouse strength of CO_2, all sources

of emissions have been studied.

Cows had been blamed for part of the increase in greenhouse gases. People had claimed that because man had civilized the west and more than 80 million cows had been brought here that were not present 100 years ago, that cows are responsible for methane, a greenhouse gas. What they failed to understand was that before the cows were here there were 80 million buffalo, and unless the buffalo had some kind of biological mechanism within them which would allow them to retain their wind there is probably an equal amount of methane now as there was before. But come to think of it, some have said that the very large heads on the buffalo and the humps on their backs may have, in fact, allowed them to store such gases!

Major new power grids being proposed years ago are now being replaced by decentralized, independent power generation facilities. There is now a new energy use ethic. Energy-efficient appliances, lights and machines have become a major contributor to our common future as people become 'Power Smart.'

Aquaculture is now a major new industry. Double-hulled super tankers with two pilots on board are now used for all oil and chemical shipments by sea. Hydrogen is being used as an efficient energy source. Fuel cells convert the hydrogen to electricity without producing harmful emissions.

Now, at last, the curriculum in schools throughout the world includes broad coverage of environmental science and economics.

Irrigation and soil alkalinity problems have been overcome and the loss of agricultural productivity has been reversed. The planting of trees is now a major part of every country's environmental program, and floods have been greatly reduced. Antarctica has been declared an environmental reserve and millions of acres of new land and water have been protected as universal parks or environmental reserves. New, safer and more efficient ways of treating drinking water have been introduced, reducing the reliance on chlorine.

Birth control and family planning methods and incentives are common in most developing nations.

The development of new urban centres near food production regions is encouraged by most nations. The amount of landfilling with municipal solid waste has been reduced to ten percent of the practice common in 1980.

Waste-to-energy plants and recycling facilities are now used and the consumption of non-renewable resources is curtailed.

Some modern automobiles are now fuelled with ethanol derived from sugar cane, corn cobs, rice hulls and a variety of other agricultural wastes.

Now that the year 2000 has come, the people of the earth have come to realize it is not enough to discover new technology or to find resources, we must always understand the consequences of the massive changes for which our world is crying out.

Finally, at the end of the millennium, in an effort to prove to you, Lord Akash, that the earth should survive, the people of the earth have developed a universal code of conduct for human beings based on new principles of sustainable development. These principles have become the common attitude among people everywhere on earth. They are adopting the lessons of the universe which you taught us 20 years ago.

The first is **Respect for Future Generations**, for other living things. "We love this earth as a newborn loves its mother's heartbeat. Care for it as we have cared for it. Hold in your mind the memory of the land. Preserve the land for all the children and love it."[1]

The second is **Responsibility**, to take part, to keep the laws of nature, to teach the young. "The ozone layer has a hole, our water is polluted, our forests are disappearing and animals are also affected by this pollution. We would like you to save our planet, if that is possible."[2]

The third is **Research**, to find better ways. "The technology that we use to abuse the planet is the same technology that can help us to heal it."[3]

The fourth is to **Reduce**, to use less, to share more. Sustainable global development requires

[1] Chief Seattle, in a letter to the President of the United States, in 1852.

[2] Aaron Meyers, aged 10, Montreal, 1990.

[3] Jacques–Yves Costeau, 1981.

that those who are more affluent adopt lifestyles within the planet's ecological means, in their use of energy, for example.

The fifth is to **Recycle**, to learn from nature to put back more than we take. To bring developing countries' energy use up to the industrialized levels would require increasing present global energy use by a factor of five. The planetary ecosystem could not stand this, especially if the increases were based on non-renewable fossil fuels.

The sixth is to **Replace**, to use more renewable resources. We must change agricultural, industrial and urban practices so that we work with nature, not against her.

The seventh is to **Reap**, to do better with less. "We must all be willing to examine our relations in international trade, investments, development assistance, industry and agriculture in light of the consequences these may have for underdevelopment and environmental destruction in the third world."[4]

The eighth principal is to **Recognize our Common Future**, we are all in the same boat. Space exploration has been the midwife to the birth of a new global consciousness. The photograph of earth from space finally made us recognize that the inhabitants of earth must depend upon and support each other.

Akash, Lord of the Universe, listened carefully and he considered the progress achieved by the people of the earth and he said, "I knew you could do it if only you loved the earth more than yourselves. You have shown great potential, earthlings. Now that you have adopted the universal code you have earned the right to see if you can live by it. You deserve more time."

So, ladies and gentlemen, if the earth had only ten years to live would we change the way we do things? Would we do things differently? Would we adopt the universal code of conduct if it meant survival of the earth? Of course it was all only a fairy tale. Or was it? Thank you very much.

Questions Directed to Dr. King at the Forum:

Question: Do you expect the public in the developed world to accept a reduction in lifestyle to achieve global environmental goals?

Dr. King: It's a philosophical question and I appreciate it. I guess what the speech tonight was about, ladies and gentlemen, was that we may not have that choice. My personal opinion, for what it's worth, is that we don't have a choice. I don't expect people to accept it, but without some control over the way the earth is going, particularly with the effects of population growth and the expectations of those new citizens arriving on earth to continue using energy at the same rate we're using it; something's got to give.

We've got to get a lot smarter, a lot better, or else reduce our lifestyles. What I said did not imply that we had to reduce our lifestyles, but it may be inevitable.

Question: What role do you see industry playing in changing public attitude to energy use?

Dr. King: Well, I think what industry is doing here today is an example of the kind of thing that we need more of in the world. If industry could invest more in children, I think there'd be a better world 20 years from now. Most of you in this room would agree with me, that the real environmental education that we were taught in school was very close to zero.

I recognize that today it's been improved quite a bit but there's lots of room for further improvement. So if industry and government could collaborate to teach our young people what they need to know in order to understand where the world is going, I think that would be a very good start. Of course, industry itself has to start in its own back yard. Most of us come from industry. I know I do, but only in the last ten years has it become extremely obvious to me that there's much more that could have and should have been done by industry to reduce the production of waste. That's the best way to do it. And once waste is produced, industry must ensure that it is safely disposed of.

Question: If education can make a difference should we not be applying more of society's resources for this purpose?

Dr. King: Yes, perhaps I've already answered that in one of the previous questions. I really believe if you were to ask me what was the most

[4] Rahel Surlieu, former Minister of the Environment, Government of Norway.

important idea that I could leave with you going out of here today, it would be that we must improve the quality and the quantity of the education of our young people. I mean that most of you have many years of productive life left, and if you learned even two things tonight that shocked you then maybe there are 200 more things that you need to learn in order to have a proper understanding of the ecological problems that this world faces today.

Question: How can we as individuals make a difference?

Dr. King: Well, I think it is an attitude thing, as Lord Akash said; the quality of your life depends on the quality of your thinking. Many of us, and by the way, I apologize for one thing; you should never do this after giving an address, but the address I just gave you was pretty negative, wasn't it? It was intended to be shocking in the sense that things I spoke of all seemed to be bad. I didn't talk at all about things that were improving, except perhaps at the end.

I think we should take a positive attitude towards what we must do. We should encourage and recognize people who do environmental good. I wonder why we don't have a Green Award of some sort, equivalent to the Academy Awards or the Nobel Prizes or something like that, where the great people who are actually doing things to preserve the species and the environment could be recognized on television worldwide. That would go a long way to bring recognition. Individuals need to promote that through their politicians and others. If we all start to believe, this dream can still come true.

Question: Do you think that the most dangerous attitude is that we think we can fix anything?

Dr. King: That would be dangerous. I hope nothing that was said in the last hour gave that impression. In fact, I just apologized for quite the reverse, that it may seem to be an almost impossible task, and it isn't. It's quite possible. But believe me, none of us will live long enough to see the day when there are no remaining problems of the magnitude that we have to face today.

It's really a question of reversing a trend. We are now going downwards, and bringing that trend to a halt and changing it into an upward condition, I think we'll be able to pass on a good legacy to our children.

Question: Is sustainable development not a contradiction in terms?

Dr. King: Well, I'm glad I didn't invent the term. I don't think it is. It was invented, by the way, by the Commission on the World Environment, the Brundtland Commission. It simply means that we must recognize that development must go on. I think you understand the pressure of people being born. How will those people be fed, how will they be clothed, how will they maintain a minimum human life? Only if there is continued development to keep pace with their needs.

I guess the point that I'd like to leave you with tonight is that it must be sustainable, and that's the definition that most people are putting to it. You cannot stop the development and the use of resources. But it must be done within the limits of those resources.

Question: What have you done personally with your lifestyle, both at home and within your professional life?

Dr. King: Well, I sit on a few environmental committees because I have opened my mouth too often on this!

And I've tried composting. It sounds very modest, I know, and I hope you're trying it too. It works. It's kind of a neat thing. I only began composting last year. I'm sorry to say for all the previous years I used to do what many of us do, and that is to put the garden rubbish in a green bag and let the city pick it up and do something with it.

I've spoken to politicians and I've spoken to the public as often as I can about this and I think that may be the most effective way. Let me give you an example, I don't want to take too much of your time, but I live in the city of Calgary. The city of Calgary boasts that it has a 50-year supply of landfill. I went to see the mayor and I said, "Does that mean that we're going to be using the landfill the way we use it now for the next 50 years, or what does that mean?"

He kind of paused because it looked like it was a trick question, and I guess it was, and he

said, "Well, things will be getting better in terms of recycling and other things but, yes, that's basically what it means." I said, "Well, I think that's disgusting. We must stop using landfills." Which one of us would allow our own garbage to accumulate in our backyard? And yet that's exactly what we do every Tuesday morning when we put out our bags and it goes to the landfill site.

If we do that because it's the most sanitary thing to do for the moment, then it's excusable, but if we do it without thinking about it and without trying to stop it, then it's not excusable. That's the kind of change in attitude that I would like to see, and it's come over me, particularly in the last ten years. Way back in my history, I used to be in the oil recycling business with a company called Turbo Resources.

We used to have to beg on bended knee before government to get them, the government, to stop using used motor oil to put down dust on the rural roads of Alberta. Today it's a crime to do that. You would go to prison, because that oil is carcinogenic and must not be distributed back into the environment. That's how much progress we've made in, let's say 20 years. More can be done.

Question: Present politicians have to make today's decisions. Students now in school, who are more environmentally aware, will become decision-makers in time, but then it may be too late. Comments, please.

Dr. King: Boy, that's another tough philosophical one! In spite of the negative speech, I'm a positive thinker with regard to this. One of the troubles with predicting the future is that we always extrapolate what's happening now more or less out on a straight line without believing that mankind will be able to adopt a major change in direction in order to solve a problem that's this critical.

So if you were to extrapolate what we're doing now for another 20 years, perhaps it's going to be too late, even if we have properly educated our young people. But I don't believe that you and I are going to go out of this conference in two or three days and continue to live a life of waste and inefficiency from an environmental perspective. We are changing, and we will continue to change. The more we talk about it, person-to-person, the more effective we're going to become in being able to make these changes. So I don't believe it will be too late at all.

Question: At Hydro's 1989 Energy Forum, Maurice Strong talked about two types of development: one, economic development, was a quantitative increase in our present growth, whereas he defined sustainable development as a qualitative change in lifestyle. Your comments?

Dr. King: I agree with that comment. Sustainable development is a term that is difficult for most of us to grasp, and I recognize that some people here may be against the concept of sustainable development. It's a philosophy. It's a way of life and therefore you can't feel comfortable with my definition or probably with Madam Brundtland's definition. So we have to recognize two things pushing in opposite directions at the same time.

One is the onward march of the population growth. This is a fact. There is no question about it, as Maurice Strong has pointed out to you. That's going to put a lot of pressure on the environment. On the other hand, we have this philosophy of 'sustainable development' which is being touted as a method of fighting this onward-marching fact. I'm simplifying, I realize, but I think that's the nature of the question. Can a philosophy defeat a fact? Again, it comes down to attitude, which is not measurable.

If you go out of this Forum and get five friends convinced that there's more that you ought to be doing in a small way in your yard and with your politicians and elsewhere, then that will make the difference, and the philosophy will overcome.

Question: How do you involve all people equally in these decisions? Is it necessary to do so to achieve your vision?

Dr. King: Well, are the people you're talking about in this room, in this country or even on this continent? I think that the organization of the environment is best done by governments, and that's one way to do it. What concerns me more than that, if I can digress a bit on the question, is that out there are some innocent people who will be going to bed hungry tonight, about seven percent of the world, and they have much less opportunity than we do in finding solutions to their problems.

We in this room will live long enough to outlive our current wasteful ways. It's the people who are being born, and 94 percent of the people being born today are being born into developing countries. The scary thing about that for me is that those people have the least ability to do anything about it. That means that six percent of us, or if you like a more generous number, 10 or 20 percent of us, have to do an awful lot to achieve sustainability for those less fortunate. Because at the present time, I don't believe it's possible to involve them to the same degree in the solutions. We in the developed world control the solutions, because we use 80 percent of the resources.

Question: In view of what we heard tonight, how can we justify building gas-fired plants in British Columbia dedicated to the export of electricity?

Dr. King: Well, if you're going to have to use a non-renewable resource to generate electricity, gas-fired plants would be one of my favourite choices, because they are the least polluting of all electric energy sources, other than the natural ones like hydro, wind, solar and so on. I think that, once again, it's a balance between the use of a natural resource in a clean, environmentally safe and friendly way, which natural gas is quite capable of doing, and the standard of living that it can create for others.

That's what natural gas should be used for. Otherwise we wouldn't have the electricity. So I'm in favour of using natural gas, but I'm also more in favour of looking at other means of eliminating the need to use natural gas. I don't think that those are two separate positions. They are the same position.

We have a limited supply of natural gas, so eventually somebody is going to make the decision for us. What are we doing now to make sure that we're ready for that day? Suppose that day was just nine years from now at the end of this millennium; are we going to be ready with enough other sources than natural gas? It's that kind of attitude we need more of.

Question: The automobile is the principal environmental problem. How can a free societycurb its use ?

Dr. King: Well, I wish I knew. Lee Iacocca should be your next year's speaker, I think. I have an automobile and I'm sure everyone in this room does. I use it literally every day. I guess the shocking thing is this; you would burn two litres of gas to go down to get two litres of milk at the corner grocery store, moving this 3500-pound monster down the road to do things that are probably unhealthy for you, or at least the alternative would be more healthy.

I'm not going to be Dr. Dean Nadell here tonight but one of the problems we are going to have to face is a more reasonable use of the automobile. One of the things that would bother all of you as it does me is the diesel emissions that you see. Somebody recently started a diesel emission hotline or a frustration line or something, and you couldn't get through on this line to begin with, because there were so many people phoning in to report, "Hey, a big truck just went by and blew a big black cloud of smoke at me. Do something!"

If that bothers you, then I think you're like me. I think we can do a lot more, a lot more down the road to making sure that the car doesn't do as much damage as it used to. Think back to the days before the catalytic converter, and fuel injection and other advances. Because of the catalytic converter changes and some of the other combustion changes, the price of the car went up by $2,000, although you may have forgotten about that. Those are just some examples. We have absorbed these improvements and we are still using our cars, but the cars are cleaner. We need more of that.

Question: Industry in general has poor credibility with the public. What do you think industry should do to improve its poor image?

Dr. King: Well, they've got to hire environmental experts because the problem is, as I mentioned before, we all came out of school and university with our M.B.A. degrees or whatever it is that you have. Unless you were an environmental engineer or in one of the earth sciences or a related field, you weren't capable of understanding the problems that we were creating. That is, not until recently. Now there's no excuse.

If you are a major corporate executive, a CEOor somebody like that, you should be thinking about a number of things. First, you should be hiring an environmental group. Make sure that they report directly to you. As I mentioned, I sit

on some environmental committees, and I am a member of boards of directors. Boards of directors are ultimately responsible for the environmentally sound operation of their companies. It's no longer any excuse to claim that you didn't know that somebody was polluting your land and it was running down into a neighbouring stream or something like that.

Most corporations these days have human resources, marketing vice–presidents and all the others, but how many of us have senior environmental engineers? How many of us have environmental committees on the Board? I would say to you, as CEOs, that you risk prison terms and huge fines now, and so do governments, by the way, by their own hand, for their pollution, whether accidental or otherwise. I agree with whoever wrote the question that industry has a bad reputation and we'd better do something about it.

Question: The population explosion occurs mostly in developing countries. How can Canada contribute to limiting population growth in these countries?

Dr. King: It's an education process, and it becomes for many a religious issue, and I certainly don't want to get into that, and I don't want to offend anybody, but if you were in a boat that could not take ten more passengers without foundering, would you willingly take on thirty more passengers? It just doesn't make sense. Our population boat is sinking. The population cannot go on growing as it has been without having more children die. You see it on television almost every week. Is that what you want, or would you want education in these countries?

I think that the only thing we can do here is to support education. There is a bit of it going on now. There's more of it needed.

Question: Like 'Our Common Future', your premise is that more growth and technology will solve the problem. It is the worship of growth and technology which got us into this mess. It is difficult to see, therefore, how science and technology will solve it. Do you see that there will eventually have to be an end to exponential growth?

Dr. King: Well, let me put it this way. If we don't stop the population growth and we don't invent new and better science and technology, which seems to be getting a lot of criticism here, which I can't understand, because the alternative is a much reduced quality of life for everybody.

Someone asked me earlier, 'Do you think anyone would be prepared to accept that?' Maybe my answer should have been more blunt. No, I don't think anyone would accept it. But my answer was that it may be inevitable.

So, I am an engineer, I guess you'd call that a scientist, and I believe that science is part of the answer. Attitude is part of the answer, too. The simple logical use of resources, yes, but without science where would we be? I hope nobody here is suggesting that we stop research and development. It is absolutely critical to the development of new and better ways to live on this earth.

Einar Field: Thank you very much, Dr. King. In view of the time, I think that we'll terminate the question period at this point.

Dr. King: Thank you all. Have a good conference.

Thanks to Dr. King by Einar Field: I don't think it was a negative message at all, Frank. You gave us a very powerful message tonight: twenty years to get our house in order. You gave us a vision and you gave us a road map. I think that you inspired us to take action. So we'd like to thank you very much for coming here to begin our Fourth Electric Energy Forum.

After listening to you tonight, I have a better understanding of why the Calgary Olympics were such a success. And I'd also like to present you with a small token of our appreciation. This is a framed print of killer whales made by West Coast artist Mark Hobson of Tofino, B.C., entitled 'The Chase'.

Dr. King: Fantastic; thank you all very much.

Concluding Remarks by Einar Field: We will now adjourn this session. I invite you all to join us in Salon A on the upper level for a reception, during which we will be entertained by dancers from the Pearson College of the Pacific.

ISSUES IN EDUCATION AND PUBLIC EXPECTATIONS

Forum Organization

Conference Chairman Einar Field

Good morning, ladies and gentlemen, and welcome to Day Two of the Electric Energy Forum. And what a beautiful day it is out there.

I'd like to begin this morning by clearing up a few housekeeping items and then we'll get on with today's session, the important part of the session, which is to discuss electricity, education and the environment.

By about noon, we should have a final list of all the participants at this Forum, and this will be made available to you. A bulletin board has been established beside the registration desk and messages will be posted there. Only those of an urgent nature will be announced over here in the Forum. I ask that you check the board periodically to make sure that you get your messages.

If you have not been assigned a discussion group table yet, please check at the registration desk again, preferably before lunch. It's important that you attend the discussion groups and obviously we want your views about education and communication. Those who have volunteered to serve as table facilitators for the discussion groups are asked to attend a special luncheon, which will be held in the View Royal Room at noon today.

The Electric Vehicle enthusiasts are holding a workshop between 3:50 and 5:00 o'clock this afternoon in the Oak Bay Room, and they expect to discuss technical matters. They would welcome any delegate who would like to learn more about electric cars.

A VCR has been set up in the Metchosin Room and some excellent videos will be shown on diverse topics such as electric vehicles, alternative energy, B.C. Hydro's apprenticeship program and on POWEREX, describing electricity trade. A detailed schedule for the video viewing times is available at the desk.

For your enjoyment, the Pearson College of the Pacific Choir, an excellent choral and international folk-dance group, will be performing in this theatre tonight at 7:30. You should find tickets in your registrant's package and, if you plan to attend, we ask that you try to be here by about 7:15. At that time, we will allow any seats not filled to be made available to the public.

As I mentioned last night, the way we would like to handle questions is to have you use the question slips in your packages. Please write any question that you would like answered onto these forms, and pass it to the coordinators who will be moving up and down the aisles throughout the morning and the afternoon. However, for this morning's session, any questions that you have will be dealt with later during the discussion panel. Any questions that we don't have time to deal with during the Forum will be answered in the printed Proceedings which will be mailed to each delegate after the Forum.

Every speaker will receive a gift for coming to this Forum. But in the interests of time, the gifts will be presented to the speakers after the sessions. The gift is a framed print by Mark Hobson, who lives on the west coast of Vancouver Island. Mark has been painting scenes of the west coast of Vancouver Island since he first visited Long Beach as a teenager. He took a rather interesting route to become an artist. After earning a biology degree, he taught science at Shawnigan Lake School near Duncan, B.C., for about eight years. He then took a seasonal job as a park interpreter, directing the Wickaninnish Centre at Pacific Rim National Park to support his desire to paint.

Mark now makes his home in Tofino where he paints full-time. This particular print is entitled 'The

Chase'. It depicts two killer whales pursuing a seal through a kelp bed. We selected this award-winning image because the killer whale has become a symbol of beauty and strength in our west coast marine environment.

Thank you. This completes my housekeeping items.

Opening Remarks

Bob Wyman

Chairman and Chief Executive Officer, B.C. Hydro

Introduction of B.C. Hydro CEO Bob Wyman by Einar Field

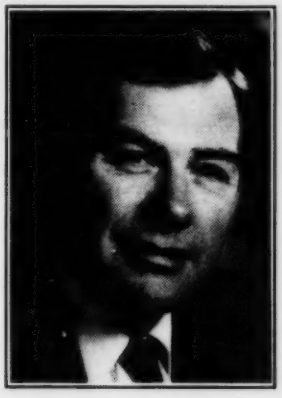
I'd now like to change hats for a moment and speak as the Vice-President of Human Resources in B.C. Hydro, and introduce to you the Chairman and Chief Executive Officer of B.C. Hydro.

Bob Wyman joined B.C. Hydro as Chairman and CEO on March 1st of this year. Despite the loads of paper landing on his desk every morning, I have a distinct impression that he enjoys his new challenges very much. We are glad to have him on board to lead the organization, which I believe is on the leading edge of corporate management in many aspects at this time, and we have strong momentum in energy conservation. Mr. Wyman has the support of a very strong team and a keen and committed work force.

Mr. Wyman holds a degree in Commerce and an honourary law degree from the University of British Columbia. Prior to joining B.C. Hydro, he had been with Pemberton Securities and its successor companies since 1962, where he served as Chairman from 1982 to 1989. Mr. Wyman is a Director of B.C. Telephone, Finning Limited and Suncor Inc., as well as Governor of the B.C. Business Council and Chairman of the UBC Capital Campaign. Mr. Wyman has been the Governor and Chancellor of the University of British Columbia and has served as a director for a number of service organizations.

Ladies and gentlemen, please welcome Bob Wyman.

Opening Remarks



Thank you very much, Einar. Good morning, ladies and gentlemen, and welcome to this Fourth Annual Electric Energy Forum.

I would like to begin today by paying tribute to two men whose vision and efforts played a great deal in all our being here today at this kind of gathering. The first, of course, is the late Jack Davis, to whose memory we are dedicating our work at this Forum. Before he passed away, Jack was scheduled to be our luncheon speaker today. If he had lived, he would have been here despite the painful battle he was waging against cancer.

Why? Because he believed in the importance of public discussion of issues relating to energy and the environment and in the values of these Forums. As the cabinet minister responsible for B.C. Hydro, Jack Davis oversaw our growth from a rather insular, construction-oriented company into what we are today, an open, customer–oriented utility which is also a leader in promoting the efficient use of electricity. Or at least, that is what we are trying to be. Later on in these proceedings, you'll have an opportunity to let us know how well we are succeeding.

While it was Jack Davis who directed B.C. Hydro to make a firm commitment to public consultation and demand-side management programs, it was Larry Bell, my predecessor, who made sure that these instructions were carried out. Larry is the second man I wish to pay tribute to today.

Larry Bell is an individual whom I have known for roughly 20 years. He started these Forums three years ago as a means of exchanging information about B.C. Hydro's resource plans and policies with the public. He wanted to get feedback and suggestions and incorporate them into our planning. I hope that those of you who have attended previous Forums have been able to see some evidence of your efforts in our plan-

ning as it has developed over that time.

One of the first assurances I gave to the employees when I joined Hydro earlier this year was that my appointment does not mean any change in the way we have been operating, and I would like to give this audience the same assurance. I am completely in agreement with the direction Hydro has taken in recent years and with its corporate objectives as they have been outlined to you at the previous Forums.

One measure of the progress we have made since these Forums began is how much broader the representation here has become. I think there are more educational and environmental groups here this year than ever before, and we welcome you all. We also have the most co-sponsors we have ever had, a total of four provincial government ministries that are helping us run things and give us some additional perspective. The co-sponsors this year are the Ministry of Education, the Ministry of Environment and the Ministry of Advanced Education, Training and Technology, as well as our original co-sponsor, the Ministry of Energy, Mines and Petroleum Resources. So we also have excellent representation from the provincial government, and I would like to thank you all for your participation.

The theme of this year's Forum is 'Electricity, Education and the Environment'. Other speakers will go into more detail on their particular fields of specialization so I would like to just give you an overview, to set the stage.

Our job at B.C. Hydro, of course, is to provide electricity. I don't think anybody would dispute that but sometimes people have questioned the way we do it. However, my impression as an outsider coming into this business is that our customers and the public generally feel that we are doing a good job of providing electric service. Indeed, if you took the public attitude research that has been carried out over the past few years, it suggests that there is a very high level of satisfaction amongst our customers with our service and its reliability. That is something that we are proud of, and we want to continue to improve on that record whenever we can.

Another thing that we are very proud of is the success to date of Power Smart. We believe that Power Smart is the most innovative demand-side management program in North America. It is so successful that we are now marketing it successfully to other utilities in Canada and we have had serious expressions of interest from other countries, including Czechoslovakia, Hungary, Malaysia, Sweden and Thailand.

But it is here at home that the success of Power Smart is most significant. In only two years since the inception of the Power Smart project, we have achieved the following:

- Our customers have saved 280 million kilowatt-hours of electricity, enough to have supplied 28,000 homes. This is well above the target that we had set.
- Public awareness of Power Smart in British Columbia is at 88 percent, up from 57 percent at the end of its first year.
- Major industrial customers have taken up the challenge, with their efforts being responsible for 30 percent of the savings achieved so far.
- Manufacturers, wholesalers and retailers also are supporting the initiative by meeting the increasing demand for Power Smart products and services.
- There are now 25 separate Power Smart programs, each one geared to the specific needs of a particular customer group or market segment, and most of them have been either newly introduced or significantly expanded in scope during the past year.

This is only the beginning, too. As I have stated, Power Smart is just over two years old. By the year 2010, we expect it will have reduced electrical demand by 5,600 gigawatt-hours annually. That is enough to meet the needs of 560,000 homes. At a planned cost of $375 million over a 20-year period, it will have been by far the cheapest way to obtain this additional supply of electricity. Since a considerable part of my career has been spent in the financial field this naturally makes Power Smart very appealing to me.

While Power Smart represents efficiency on the demand side of the electricity supply equation, B.C. Hydro is also determined to achieve efficiency on the supply side. Here we are involved in increasing the supply of electricity by such means as coordination, the Resource Smart program, and through independent power producers.

Coordination and purchase agreements with other utilities or large industrial firms provide for each party to operate its respective system in such

a way as to achieve maximum overall efficiency. We recently concluded coordination and purchase agreements with Alcan for the Kemano Completion Project in northwestern B.C. and we are continuing discussions with the Bonneville Power Administration in the northwest United States and TransAlta Utilities representing the Alberta interconnected system.

Resource Smart is a kind of in-house efficiency program in which B.C. Hydro works to improve or add to our existing facilities. For example, there are a number of opportunities where we can add generating equipment at existing dams, improve the efficiency of turbines, raise reservoir levels or lower downstream water levels or reduce energy losses during transmission. Our studies show that we can obtain nearly 5,000 gigawatt-hours of additional electrical energy per year through Resource Smart programs of this sort, that is almost eight times the amount of electricity consumed annually by the homes and businesses in this beautiful city of Victoria, where we are today.

We can also get other people to do the work for us. The role of the private sector in the generation of electricity is becoming increasingly important. Purchasing from independent power producers allows us to defer major new projects, saving us outlays of capital as well as making the best use of existing resources. The number of independent and privately owned power generating facilities which may be connected to the B.C. Hydro system is steadily increasing. The forest products industry, for example, now produces 470 megawatts of energy for its own use. This 'co-generation' is equal to approximately five percent of Hydro's total installed generating capacity. And there is potential for at least as much more. It is particularly beneficial, because energy that would otherwise likely be wasted is used for other purposes. On a smaller scale, many alternative energy options, such as small hydroelectric projects, are well suited to private development.

The second part of our Forum theme this year is education. If I can say this without making the company sound pompous, we feel that Hydro has a responsibility to educate the public about energy use efficiency and related issues. We are supposed to be the experts and people look to us for leadership. So we are involved in a great number of educational activities, both within our company and externally.

As you will be hearing this afternoon, Hydro is responding to the challenge of the aging population and expected energy resource shortages in future by expanding and coordinating these various activities into a single initiative which we call 'Partners in Education'. Our purpose is not only to provide leadership in energy efficiency but also to ensure that we will have people on our team with the skills and knowledge to lead this utility into the 21st century, and also to educate young people about the importance of electrical safety.

One particularly interesting and innovative joint venture or joint project that we are currently developing with the province's educational television service, the Knowledge Network, actually started at last year's Energy Forum in Prince George. The theme then was 'Lifestyles, the Environment and Electricity Use.' As one of the evening entertainments at that Forum, we staged an 'Energy Crisis Simulation'. We imagined an energy crisis so large and so acute, that a fictitious British Columbia community called 'Prince James' had to reduce its electricity consumption immediately by 25 %, and we asked a panel representing the community and customers to decide where the cuts would fall. Those deliberations were taped and were later incorporated into one of four one-hour television programs we have sponsored with the Knowledge Network. The series was shown in February of this year and will be repeated this fall, with copies available to teachers for classroom use. We are also proud to co-sponsor another Knowledge Network program that has been airing recently. That is 'Kid Zone', a half-hour magazine-style show that helps children learn about science and technology, and nature and the environment as well as sports, recreation and lifestyle topics.

Another one of our educational initiatives is obviously this Forum itself, and as with most of our educational programs, we are hoping to get some education ourselves during the process, because we need to know what you are thinking about energy issues, and that is all part of our public consultation process and our commitment to open communication. An educated public will make the proper choices, or at least it will be in a position to do so, and an educated utility will do the same, to the best of our ability, and with your help.

Now, as a way of underlining the important

connection between education and energy, I would like to announce the initiation of four new B.C. Hydro Power Smart Scholarships. These scholarships, in the amount of $1,000 each, will be made available annually to students at the University of Victoria, the University of British Columbia, Simon Fraser University and the B.C. Institute of Technology. They will be used to recognize achievements in the field of engineering, business and environmental resources. There will also be a requirement that each applicant for the Power Smart scholarship complete a major project or paper related to energy conservation, so as to focus students' attention on this important subject and, I hope, influence their attitudes. I am sure that many of them will come up with innovative ideas that will help us deliver the Power Smart message and programs. This is only one aspect of a current expansion and modernization of our overall scholarship program, and we will be announcing others during the coming weeks and months.

When I was talking earlier about Jack Davis, I mentioned that he had been the minister responsible for B.C. Hydro during recent years, and as such had directed us to the point where we find ourselves today. It is not difficult to think of Jack in connection with energy matters. His connections with Hydro went back a long way, to the days when he was director of research and planning for its predecessor company, the B.C. Electric Company, in the late fifties and early sixties. Nor is it easy to overlook his considerable educational qualifications: he attended the University of British Columbia and, as a Rhodes Scholar, studied at Oxford and later at McGill, where he received his doctorate. But I wonder how many people remember Jack's unique connection with the third component of our Forum theme, the environment? It was exactly 20 years ago this year that he became Canada's first-ever Environment Minister, a position he held until 1974, the year that he moved back to the provincial government.

I mention that, not only to honour Jack, but also to remind you of how far we have all come in a relatively short period of time. Can you imagine a government today that would not have a cabinet position responsible for the environment? Yet until just 20 years ago there was no such position in Canada, nor in most other countries.

So we're getting there, but we still have a long way to go. And again I want to assure you that my appointment at B.C. Hydro does not mean any change in the direction the company was taking in terms of improving its environmental consciousness. In fact, I intend, if anything, to get Hydro moving faster in this area, the third component of our Forum theme. With that in mind, at our Hydro Board meeting two days ago, we asked the Directors to form a special committee, a special Board Committee on the Environment, and that has now been implemented. Many other companies, as Dr. King mentioned last night, have already established similar committees, and now we have, too. This recognizes and demonstrates that Hydro, at our highest level, recognizes the importance of the environment. And I am firmly in support of Hydro's environmental principles, as outlined to you at last year's Forum, because I am convinced that the environment is going to be the biggest issue we face during my time at B.C. Hydro. In fact I'm convinced it's the biggest issue that business faces today and will face in the next decade.

Now, before I turn you over to other speakers who can tell you a great deal more about their particular field of endeavour than I can, I would like to draw your attention to some special guests we have with us today in the audience. They are here to help me make another announcement, which also has to do with youth and education, as well as electricity and the environment. They represent two organizations that are the largest of their kind in the world, organizations which over the years have shown leadership in their concern for education and the environment.

May I introduce, representing the Girl Guides of Canada, British Columbia Council, Mrs. Jean Goulson, Deputy Provincial Commissioner, and Mrs. Tad Letson, Environmental Coordinator. Would you stand up and be recognized, please?

And representing the Boy Scouts of Canada, B.C. and Yukon Provincial Council, Mr. Allen Ball, the provincial President, and Mr. John Pettifer, the provincial Executive Director. Thank you.

They are here to join with me in announcing that the Boy Scouts and Girl Guides have reached agreement in principle with B.C. Hydro to jointly develop a Power Smart program for both organizations. Both programs will deal with electrical safety as well as energy efficiency. Mrs. Goulson, if you would like to say a few words about this, and then perhaps Mr. Ball; and then I will con-

clude with a few short remarks.

Jean Goulson: I think both Guiding and Scouting have been very aware of the care and the importance of awareness of the environment ever since we began over 80 years ago. It isn't new. We have been very conscious of it, particularly in our outdoor program and everything that we do with the girls. In the last year and a half, we have introduced very intensive water awareness program in Guiding, both of appreciation of what we have in water and care of what is going to happen to it in the future.

So we are now looking forward very much to adding the Power Smart concept to the Guiding program. We have 35,000 girls and women in the Guide movement here in B. C., so I think we should be able to spread the Power Smart message quite widely for you, and we thank you for the opportunity.

Allen Ball: Good morning, and I would first like to thank B.C. Hydro for an opportunity for Scouting to join in on their Power Smart program. We have of course a very strong outdoor program within the Scout organization and we focus on the environment. One of the major focuses we have for Scouting is to be wise in the use of our resources. We feel that what Power Smart and B.C. Hydro's role-modelling is going to give us is not just the theory, which youth members see on a day-to-day basis, but an opportunity to practise and to go out and find out just what the need to conserve our energy is all about.

We thank you for your example. We hope other corporations will pick up on that so that we have an opportunity to teach our 26,000 youths and 10,000 adults more about the wise use of our resources. Thank you very much.

Bob Wyman: Thank you, Jean, and thank you, Allen. I am told that a great deal of Hydro's planning gets done at these Energy Forums, and the price is right for us. But seriously, we do look to the Forums as part of a continuing dialogue, and we do look to its workshops as a source of information and education that we can factor into our planning. So I will now turn you back over to Einar and we can get to work. Thank you very much, ladies and gentlemen.

Einar Field: Thank you, Mr. Wyman. You might be new to the job in B.C. Hydro, but I don't think anyone is in doubt as to the direction the company will take under your direction and your leadership. Hydro's commitment to the Power Smart program is further expressed through the scholarships that were announced today.

Developing a Conservation Ethic

Derek Henriques

Manager, Energy Management Division, B.C. Hydro

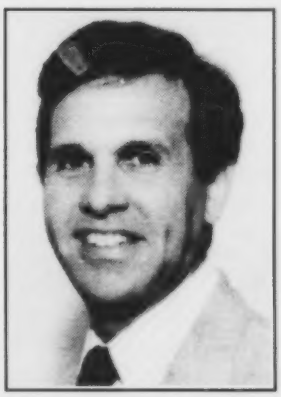
Introduction of Derek Henriques by Einar Field

Last night Dr. King offered some very serious suggestions as to how we can save our planet. This morning we are going to pursue some of those options. Energy conservation as a concept is easy to explain but to make it happen requires some specific action on our part, and that includes all of us. Developing a conservation ethic is critical to the success of the program and our next speaker will deal with this important phase of the overall task.

Derek Henriques is in charge of the Energy Management Division of B.C. Hydro. He has been with the organization since 1977 and helped to develop a number of energy conservation programs, as well as advising customers on the efficient use of electricity. He is responsible for the planning and design of all demand-side management programs as well as the research into these new energy-saving programs.

Mr. Henriques is a Professional Engineer. He is also presently the Chairman of the Canadian Standards Association Technical Committee on Electrical Motors and a director of the British Columbia Electrical Association. Ladies and gentlemen, please welcome Derek Henriques.

Developing a Conservation Ethic



Thank you very much, Einar. Good morning, ladies and gentlemen. I am delighted to be here with you this morning in this beautiful city of Victoria. I am also very pleased to be here to share a few thoughts with you about Power Smart, one of my favourite topics.

I'm going to use a few slides with my presentation, so let's get going.

Power Smart is B.C. Hydro's number one resource option. (Slide 1) You heard Mr. Wyman tell you about it and I'm going to give you a little bit more information about some of the background. Power Smart is our least-cost addition to the supply of new loads and there are many benefits besides the financial benefits. As we heard from Dr. King last night, an energy efficiency ethic will help in many ways in saving our planet.

This chart (Slide 2) shows us the world per capita electricity consumption for a sample of countries around the world. I don't think we should be very proud that Canada is found up there amongst the leaders. Other industrialized countries such as Japan, West Germany and France use less than half the per capita energy that we do. One of the reasons for this high consumption in British Columbia is primarily the price. Look at the industrial electricity prices for a sample of countries (Slide 3) and you'll see that in British Columbia we are among the lowest.

Our price reflects the average cost of electricity. Our present rate structure reflects the fact that the more kilowatt-hours you deliver to a particular customer with a given load, the lower the cost of serving that customer becomes, because it's incremental for the infrastructure that's built. However, this form of rate structure has been changed in many parts of the world to reflect the marginal cost of new supply, which is significantly higher than our present average supply cost.

B.C. Hydro has applied to the British Columbia Utilities Commission to revise the rate structure so that the final or incremental kilowatt-hours of energy used will, in the long term, reflect the marginal cost and, hopefully, will provide a signal for users that the cost of conserving energy can have a very rapid pay back.

Power Smart started with a mission, as with all good projects, you've got to know what you're setting out to do. (Slide 4) Our mission is to reduce the rate of consumption of electricity in a manner that is cost–effective, and is sustainable, which is very important, and also serves our customers' needs and their concerns for the environment. We've heard Mr. Wyman talk about energy and the environment; the two are very closely connected. The strategies that we plan to apply are to use our resources for activities that will, in the long term, establish a new electric efficiency ethic through three main areas of opportunity: (Slide 5)

- Change the current usage, by showing our customers that the benefits of using electricity more efficiently are quite significant and will result in lower bills and reduced environmental impacts of load growth.
- Influence new purchases, such as the purchase of more efficient refrigerators or light bulbs or electric motors. We have programs that address these areas.
- Provide leadership in the development of future usages of electricity by the development of efficiency–performance standards for all energy–using equipment.

What is an energy efficiency ethic? (Slide 6) We think it is when energy is considered in all business and personal decisions, just as we now are instructed to consider the environment in all our decisions. The second principle is that electricity is considered at its value and not its price. What I mean by that is that the value is the long-term marginal cost of the resource including externalities and not the current average price that we pay for it today.

We are planning to employ five strategies in achieving this change. (Slide 7) They are technological, economic, political and legal, educational and social marketing. We think of the technological strategy (Slide 8) first as product modification. To give you a couple of examples, this could be improving the insulation of your homes or wrapping water heaters with blankets to reduce the amount of losses. Second, there could be product substitution, and that could involve replacing an incandescent light bulb with a more efficient compact fluorescent light bulb, or changing all the street lights to high-pressure sodium, one of the most efficient sources of electric illumination. And third, product innovation can be achieved by promoting the development of more efficient appliances and energy-consuming equipment.

This could, for example, involve the adoption of the new variable–speed drives used to control the power consumed by industrial motors or it could be simply new technology that has not yet been developed.

Economic strategy (Slide 9) deals with things like cost imposition, and here is where our application to the BCUC to increase the trailing step of our rate would end up with some cost imposition for the higher consumers. At the same time, we should have rewards, grants or rebates and recognition for energy innovation.

Our political and legal strategy (Slide 10) is to work with the government and other agencies in assisting in the development of legislation such as the **Energy Efficiency Act of British Columbia** which was passed by the legislature last year and also by working with the various parties involved in upgrading the Building Code so that energy efficiency requirements are built into the Code. The regulations will mandate the minimum levels of efficiency that are acceptable or allowed, and we work closely with all the government agencies that develop these standards and regulations to make sure that we can cooperate and get the best value for our money.

Our educational strategy (Slide 11) deals with information, providing technical information to facilitate informed decisions. We provide support and we're involved with working with various educational institutions and provide support for the development of materials to transfer the information on energy to our students and to the population at large. You've heard about the various initiatives that we have with the educational system from Mr. Wyman this morning and you've also heard about the Power Smart scholarships. These are a beginning, a beginning in the right direction. We structure information to create a strong desire for participation. Sometimes this desire is created by things like $50 rebates.

Social marketing (Slide 12) is the final strategy and we have taken a number of steps that we hope will assist in changing the energy efficiency ethic. The first step (Slide 13) is to try and change attitudes by promoting, telling everyone about the benefits of participation, providing stimulating materials to help understand the fundamen-

tals of energy decisions, and of course, emphasizing the educational aspect in our schools.

We also have to eliminate any of the barriers. (Slide 14) Why don't people accept things? Well, there are always a number of barriers; financial barriers, informational barriers, availability of products and so on. Well, for the informational barrier we are providing information that's made available throughout the province. We have a simple toll-free number which anyone can access anywhere and receive information within a very short period of time.

Our incentive programs, through Power Smart, provide additional benefits to participation. And of course the most important is that the products that we are promoting must be available, so we work very closely with our allies, the retailers, wholesalers and manufacturers of products to make sure that they are on the shelf.

Another step is to attempt to change behaviour directly (Slide 15) by setting appropriate rates and tariffs, by the structure of the rates, by the connection fees and so on, and by assisting in establishing codes for buildings, appliances, lighting, motors, etcetera, and then by standards. You have to have the standards by which to measure your success, and so we have to set standards. It's very important.

Finally, legislation and regulation, so that once our society has tried a standard and responded to rebates, some form of regulation is necessary to institutionalize the change that has occurred. Step 4 (Slide 16) is to reinforce that new behaviour by promoting to maintain enthusiasm, by educating again, by asking our partners in education to help us to provide accurate information in the educational system to reinforce the new behaviour, and of course we always need rewards, to provide recognition to participants and/or sometimes financial incentives, as well.

I like to think of Power Smart as the partnership or synergy of partnerships (Slide 17) between utilities, manufacturers, retailers, governments and of course the most important factor of all, our consumers. We have many Power Smart partners in the city of Victoria. We heard last night that the University of Victoria has opted to become Power Smart. The Commonwealth Games facilities will be Power Smart. The ornamental lighting that you see on the waterfront here is Power Smart lighting. There used to be incandescent light bulbs in those globes. Now you have compact fluorescent light bulbs, using 75 percent less electricity than previously.

If you notice the lighting in and around the Parliament Buildings, they are also Power Smart. The external lighting on the Parliament Buildings were retrofitted last year and achieved a 40 percent electricity savings and very little additional cost for purchase of the equipment. Briefly, Power Smart is a dynamic series of programs that address all sectors, the residential, the commercial and the industrial.

In the residential sector (Slide 18) we have a sampling of programs for improving homes, for assisting in the purchase of more efficient refrigerators. Did you know that in B.C. we have over 300,000-plus older refrigerators which were banished to the basements when a new refrigerator arrived in the home? We are planning to buy back some of these refrigerators because the energy saved by not having them plugged in is a tremendous advantage to us.

Also we have Power Smart water heater programs. We're trying to encourage people, along with the gas company, to convert from electric to gas-fired water heaters. First of all it's much more efficient, to burn gas at the burner tip in a water heater rather than using the gas to generate electricity at a thermal generating station and then transmit the energy through electric transmission and distribution lines to an electric water-heater. We have a hot water saver program where we provide low-flow showerheads and also wrap water heaters with blankets to reduce energy losses.

We're promoting the adoption of improved building construction standards in the Quality Plus home education program. The course has an energy education component, and in our non-integrated areas, where we have diesel generation, we're putting a special effort into promoting the adoption of more efficient technology.

In the commercial sector (Slide 19) we offer a number of programs. The energy-efficient lighting program could ultimately reduce our lighting energy consumption in the province by over 50 percent, perhaps up to 75 percent. Amory Lovins, who spoke at our first Electric Energy Forum in 1988, says we could ultimately reduce

commercial lighting loads by as much as 90 percent, but he's being very optimistic.

The building improvement program is for improving the shell and the operation of commercial buildings. Where new buildings are in the design stage, we get together with the architects and the consultants, and work with them and the owners to ensure that they construct power smart buildings.

Of course, we have not neglected the industrial sector, (Slide 20) which is our largest electric energy-consuming sector in the province. In fact, the industrial sector uses over 45 percent of all electrical energy produced in British Columbia. We have programs for the adoption of high-efficiency motors and more efficient compressed air use. We have a 'Bonus Partners' initiative, which encourages customers to come in with their own innovative energy–saving ideas. We like to use the innovations of our customers because there's a tremendous wealth of knowledge and talent out there.

Our achievements, to the end of January this year, are shown in Slide 21. We had over 122,000 residential consumers participate directly in our rebate programs, and in the commercial sector, just under 3,000, and in the industrial sector just over 800. The number has been climbing rapidly and we are on a very steep incline right now.

Ladies and gentlemen, that is why Power Smart is B.C. Hydro's number one resource option. (Slide 22). Thank you very much.

Thanks by Einar Field: Thank you very much, Derek, for providing an excellent focus on energy conservation, and for outlining some specific opportunities in developing our conservation ethics.

POWER SMART

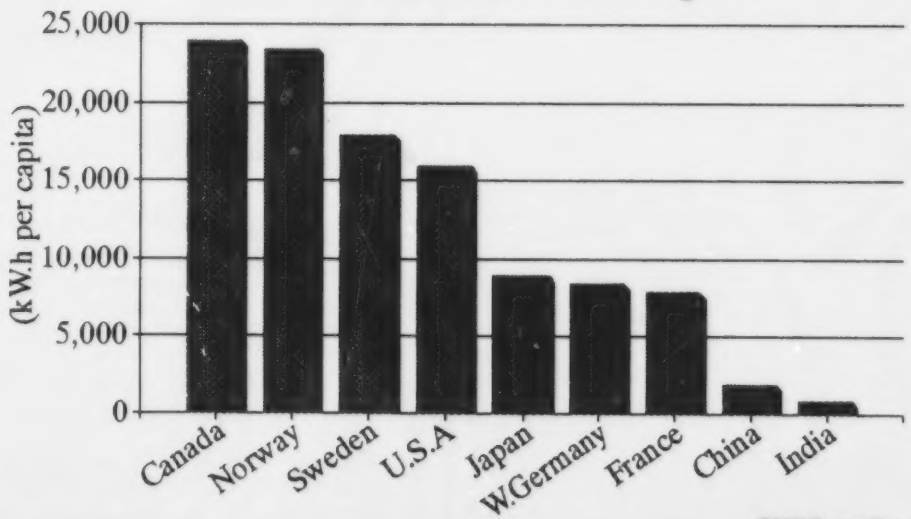
Power Smart is B.C. Hydro's number one resource option.

BC hydro

Slide 1

POWER SMART

World Electrical Consumption

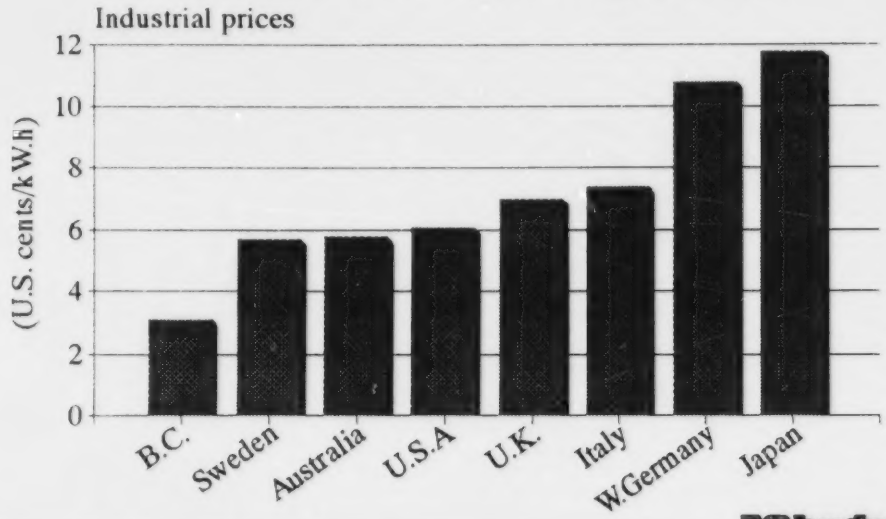


BC hydro

Slide 2

POWER SMART

International Electricity Prices



BC hydro

Slide 3

POWER SMART

Mission

To reduce the rate of consumption of electricity in B.C. in a manner that:

- is cost effective
- is sustainable
- serves our customers' needs and their concerns for the environment

BC hydro

Slide 4

POWER SMART

Strategy

We will apply resources to activities that will in the long term establish a new electric energy efficiency ethic through three areas of opportunity:

- Change current usage
- Influence new purchases
- Provide leadership in the development of the future usages of electricity

BC hydro

Slide 5

POWER SMART

Energy Efficiency Ethic

- Energy is considered in all business and personal decisions
- Electricity is considered at its value and not its price

BC hydro

Slide 6

POWER SMART

Five strategies in achieving social change

- Technological
- Economic
- Political/Legal
- Educational
- Social Marketing

BC hydro

Slide 7

POWER SMART

Technological Strategy

- Product modification
- Product substitution
- Product innovation

BC hydro

Slide 8

POWER SMART

Economic Strategy

- Cost imposition
- Rewards

BC hydro

Slide 9

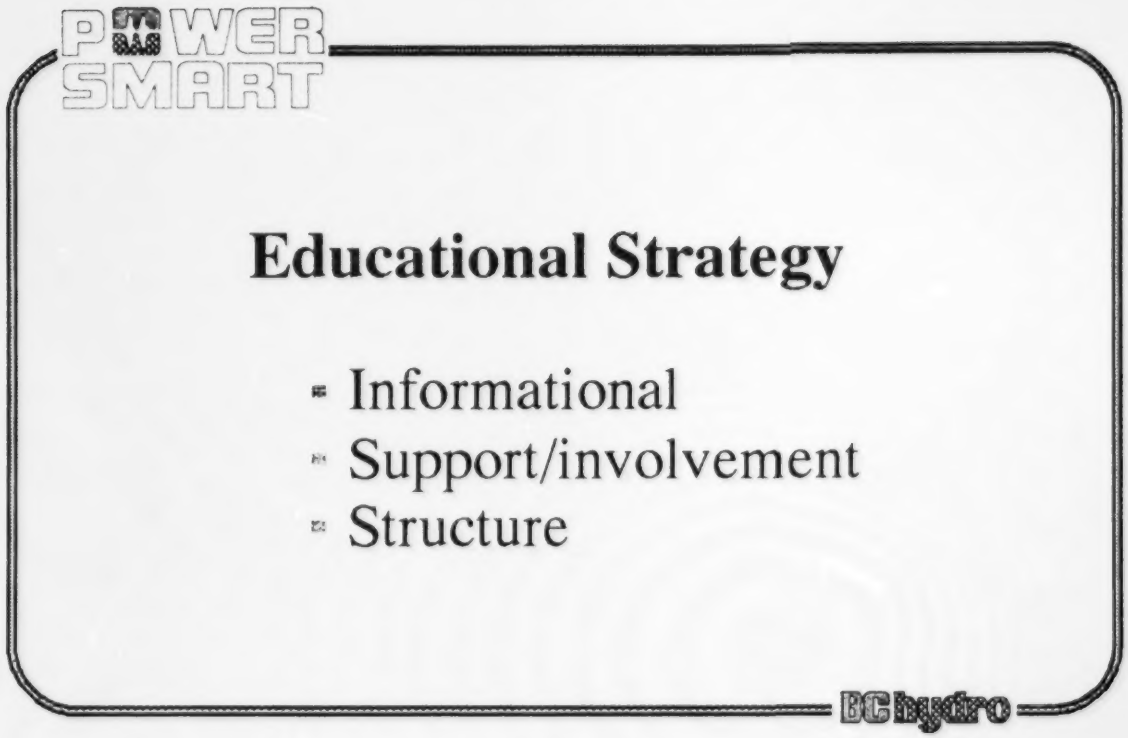
POWER SMART

Political/Legal Strategy

- Legislation
- Regulation

BC hydro

Slide 10



Slide 11

Slide 12

POWER SMART

Step 1:

Change attitudes

- Promotion
- Education

BC hydro

Slide 13

POWER SMART

Step 2:

Eliminate barriers

- Information
- Incentives
- Availability of Products

BC hydro

Slide 14

POWER SMART

Step 3:

Change behaviour directly

- Rates
- Tariffs
- Codes
- Standards
- Legislation/Regulation

BC hydro

Slide 15

POWER SMART

Step 4:

Reinforce new behaviour

- Promotion
- Education
- Rewards

BC hydro

Slide 16

POWER SMART

Power Smart is the Synergy of Partnerships

- Utilities
- Manufacturers
- Retailers
- Governments
- Consumers

BC hydro

Slide 17

POWER SMART

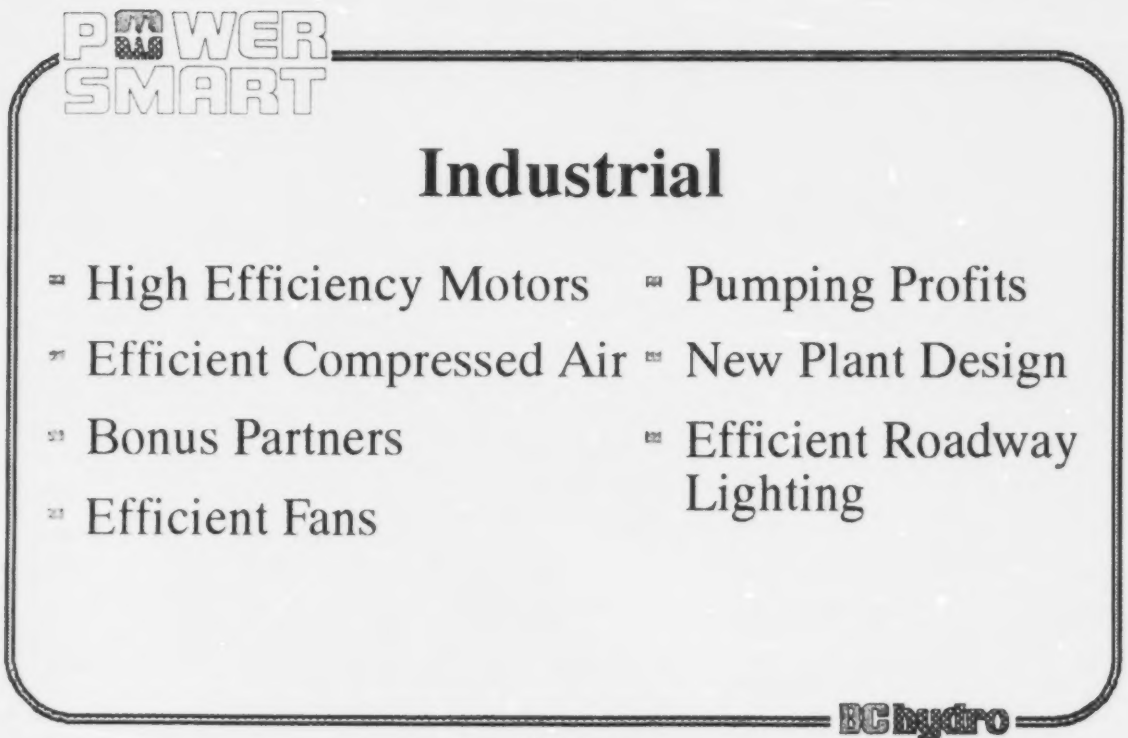
Residential

- Home Improvements
- Refrigerator Efficiency
- Refrigerator Buy-Back
- Power Smart Water Heaters
- Electric to Gas Water Heaters
- Hot Water Saver
- Quality Plus Home
- Energy Education
- Non-Integrated Areas

BC hydro

Slide 18

Slide 19



Slide 20

POWER SMART

Achievements to Date*

	Number of recorded participants	*Energy savings GWh/year*
Residential	122,786	85.1
Commercial	2,774	93.6
Industrial	816	73.0
Total	126,376	251.7

* to January 31, 1991

BC hydro

Slide 21

POWER SMART

Power Smart is B.C. Hydro's number one resource option.

BC hydro

Slide 22

Opportunities in Science and Engineering in the Energy Industry of the Future: The Challenge of Intellectual Stewardship

Janet Halliwell

Chairman, Science Council of Canada

Introduction of Janet Halliwell by Einar Field

Science and engineering are key contributors in support of the ethics that Mr. Henriques spoke about, and here to discuss opportunities in science and engineering is Ms. Janet Halliwell.

Janet Halliwell was recently appointed Chairman of the Science Council of Canada. She is working to promote the development of science and engineering across Canada. Before her appointment to the Science Council, she managed the Strategic Grants Program as well as other programs for the Natural Sciences and Engineering Research Council. Ms. Halliwell holds a Master of Science degree in physical organic chemistry from the University of British Columbia.

Ladies and gentlemen, please welcome Janet Halliwell.

The Challenge of Intellectual Stewardship

Thank you very much, Einar. It's a real pleasure for me to be here with you today on the West Coast, in the province where, as many of you will know, my heart really lies, and to participate in this, the Fourth Annual Electric Energy Forum, a farsighted initiative providing us with the opportunity to explore harmonization of the energy and environmental concerns that increasingly dominate our thoughts, to say nothing of the news media.

The guidelines given to me by the conference organizers inferred that I was to address the opportunities in science and engineering for the energy industry. Rather than recognizing that this calls for an almost impossible compression of an incredibly complex subject, let me admit my affinity for tackling the impossible. So I'll try, in the next 20 minutes, to develop my theme of 'Intellectual Stewardship.'

I will approach this task in keeping with the tradition of the Science Council, which is an arm's length advisory body. It's forward looking and it's not constrained by what I will call the tribal customs of academic disciplines or of political time horizons.

To set the stage, let us go back some 15 or 16 years to 1975 when the Science Council of Canada was initiating a major study entitled 'Canada as a Conserver Society.' What was meant by these words 'conserver society' and what was the vision of the future problems and opportunities? Let me quote:

> "The concept of a conserver society arises from a deep concern for the future and the realization that decisions taken today in such areas as energy and resources may have irreversible and possibly destructive impacts in the medium to long term.
>
> The necessity for a conserver society follows from our perception of the world as a finite host to humanity and from our recognition of increasing global interdependence.
>
> A conserver society is, on principle, against waste and pollution. Therefore, it is a society which:
> • Promotes economy of design in all sys–

tems, i.e., by doing more with less;
- Favours reuse or recycling, and whenever possible, reduction at source;
- Questions the ever-growing per capita demand for consumer goods artificially encouraged by modern marketing techniques;
- Recognizes that a diversity of solutions in many systems such as energy and transportation might, in effect, increase their overall economy, stability and resiliency."

These were very prophetic words when you recognize that they pre-dated the Brundtland Report by many years. They pre-dated much of the green movement that we have seen. As well, they pre-dated a lot of the hard scientific evidence that we now have on environmental challenges that result from population expansion and the economic activity that goes with that population expansion. These pressures are reshaping conditions for life on our planet. We now have scientific evidence that there is a change in the composition of our atmosphere and that we are faced with a different climate and higher levels of solar radiation.

But these words from 'The Conserver Society' report were also developed before we recognized that our insatiable demand for land, and the renewable resources thereon, could also threaten or at least change the regenerative capacity of our biosphere. Without reference to the debates that are now gripping B.C. in the forest industry, these can be exemplified by such things as the expansion of the world's deserts, now increasing at a rate of about 60,000 square kilometres a year, an area which is about the same as Nova Scotia and Prince Edward Island combined.

The interesting thing about that early report of the Science Council is that it did not renounce science and technology. Nor did Bruntland. Nor should we today.

We must not see the solution of current and forecast problems to be a slowing of the productive systems of this country or a sliding into the backwater economic status defended by some other worldly set of values that disdains science and technology because of the societal value that their use represented in the past. There's no doubt that they have created problems, but we must use science and technology as part of the solution.

So let's take a look at what I will call the energy equation; a brief look towards the future. I'd like to take out a crystal ball that is tuned to the mid-21st century, and look quickly at some of the opportunities that lie in energy supply and energy demand, but even more interestingly, in the environmental and societal implications and constraints. I'd like you to recognize that these can be, at most, quick overviews with samples of some of the opportunities and challenges.

First, energy supply; what we're working with. Let me suggest to all of you that despite the fact that you are, in B.C., blessed with a remarkably efficient and clean hydro-electric energy source, we cannot be parochial and talk only of Canada. The political events of the past few months have reinforced the trans-national nature of energy issues, as have scientific measurements of pollution in the Canadian Arctic, pollution that has had its origins in the coal-powered generating stations of central Europe. Very accurate modelling has demonstrated the correlation of wind patterns and pollution deposition.

You should realize that oil and natural gas together comprise 64 percent of the total energy supply in 1990, and I haven't even mentioned coal. The exact status of world oil reserves remains extremely controversial, as you'll note in reading the literature, but current forecasts estimate the availability of petroleum and natural gas reserves to be enough for, at most, about 30 to 40 more years. This estimate assumes that they will continue to be the dominant energy source and ignores, for the moment, environmental concerns about their use.

But it also ignores the fact that we are high–grading relatively clean energy sources. It also ignores the fact that current prices do not encourage exploitation, and at these prices, it may be a long time before the Canadian heavy oil reserves are exploited.

Let's turn to coal, because coal is also a dominant source and a problematic one, if one looks at the global issues that we face. Coal currently supplies about twenty–two percent of the world energy demand, bringing the fossil fuel contribution to eighty–six percent of the total. Coal tends to be a dominant energy source in heavily industrialized but not in technologically advanced countries. For example, consider China. With twenty percent of the world's population, it is

heavily reliant on coal, as is eastern Europe.

One has to ask for how long and at what price. Let's take a very quick look at what's happening with the use of coal in China. We're all concerned about CO_2 loading of the atmosphere, whether or not we view CO_2 as the most serious of greenhouse gases, (we all have to recognize that methane is a somewhat more interesting part of that overall equation), but fossil fuels used to generate electrical power also create a great many atmospheric problems in addition to CO_2.

Thermal generating stations, no matter what source of fossil fuel they use, are notoriously inefficient. China's coal-fired plants are said to be running at about twelve percent. With twenty percent of the world's population, imagine what a four-fold increase in plant efficiency would mean. But what does that four-fold increase mean in terms of challenges to science and technology?

Canada's fossil-fuelled thermal generating plants operate at about 30 to 35 percent efficiency. Even Germany's ambitious target of 52 percent in its thermal generating plants by the year 2005 requires further technological changes from the advanced fluid-bed combustion technologies of today.

Furthermore, Germany intends to penalize those plants that do not meet their state-of-the-art efficiency targets. There are opportunities here for Canada, with its high tech energy expertise, to contribute to this upgrading work. However, while improved efficiency targets in reducing toxic and persistent waste products are technological challenges, they are unlikely to be enough.

Of the remaining fourteen percent of energy that does not come from fossil fuels, nuclear now provides six percent of the world's power, hydro and other renewables eight percent. They are not yet major contributors.

We have a unique and special situation in this province, where there is a vast potential for the increased development of renewable resources, but we have to also recognize the down side, the environmental effects, and the potential imposition of the values of economic growth on people who do not share the same value system.

Furthermore, renewables, such as hydroelectric and nuclear, cannot easily power your conventional family car, nor can they power the ferries that ply the straits between here and Vancouver, nor the jet aircraft that facilitate trade and tourism in the Pan Pacific area.

So we have a problem. We've got a tremendous reliance worldwide on fossil fuels. We have a time line which says 30 to 40 years from now we are going to start seeing a decrease in supply or at least a change in the quality of that supply. We have a crunch coming along. Are we ready to meet it?

What about the alternatives? Yes, there's fusion, but fusion is a power source that is unlikely to be commercialized for at least 50 years and I would say more like 80. Bringing it to commercial realization will be a major technological challenge.

Use of renewable resources may increase, but not as a major energy source in much of Canada. The economics of renewables are not such as to give hope of early viability.

On photovoltaics, the numbers that I have indicate that the cost of photovoltaics is now running at about 75 cents a kilowatt-hour. Hydroelectric power in Ontario costs about five cents a kilowatt-hour. In Japan, conventional power costs about 25 cents per kilowatt-hour. So renewables present a technical and economic challenge. We've got to see a change in the economics or see a major change in the pricing structure before they become viable.

Hydrogen as a fuel is potentially very interesting, but again there are technological problems. If David Scott does have a chance later this morning to talk about hydrogen, I have no doubt that he will address the challenges and the problems: problems of storage, problems of safety and problems of cost.

The bottom line on the supply side is that there is no silver bullet, no ideal solution. We are going to require a diverse and complex mix of energy sources and we're going to have to take a broad systems approach to energy supply.

You should not be complacent about the relative quality and security of B.C.'s heavy reliance on hydroelectric power. It's clean and cheap but it won't supply your energy needs for transportation without tremendous changes. And re-

member, you also suffer droughts about one year in twenty, when you may have to buy fossil-fuel power from your neighbours.

Nor does it contribute to what I call the emerging energy appetites of lesser-developed countries or indeed the newly industrialized countries like Korea, Malaysia, etc. Here I see special opportunities for the export of Canadian expertise in energy technologies and through energy-efficient and environmentally-friendly products and services.

But, in many respects, the supply side of this equation, no matter how seemingly complex, is the relatively simple one.

The real levels of challenge and difficulty come when we look to the demand side of the equation and we consider the environmental and societal aspects. Let's turn to demand.

Derek Henriques has described some of the demand side energy reduction options, which include new technology, energy and system efficiency, fuel switching, alternative energy use, design economy. We also have to look at improving public appreciation for alternative energy consumption, and here PowerSmart is a program that is designed to do just that.

But there are other examples that we should be looking at. Today's cars are 70 percent more fuel- efficient than those made before the 1973 oil embargo, and the marketplace already offers vehicles that have a fuel efficiency of at least 40 percent higher than today's average of 8.6 litres per 100 kilometres. Even beyond that lie opportunities for further gains in efficiency with new lightweight materials, and improved aerodynamic design for automobiles, recreational vehicles, buses and other forms of mass transportation.

Innovations emanating from information, technology and new materials are revolutionizing production engineering and the process of technological development, for example, by the use of computer simulation, design and modelling.

Another major problem with the demand side of the energy equation is the fluctuation of load on the energy grid. Utilities have to keep a power reserve, perhaps a 25 percent reserve, for response to peak demand situations, and that is an inefficiency inherent in most electric utility systems.

There are hybrid heating systems now in use in Canada and the US that allow electrical utilities to operate at much higher efficiencies by blending the use of electricity and oil or gas furnaces for household heating. In essence you have a combined fuel source. If there's a surge in demand on the grid, a block of residential oil or gas furnaces are kicked in by a signal from the utility itself, which reduces the peak load on the electrical power grid, permitting the electrical generation plant to run at a much higher utilization level.

Minnkota Power Cooperation, I believe it's called, in Grand Forks, North Dakota, is actually using this idea. They are now able to operate their thermal plants at close to a 100 % load factor.

One could list many more examples of opportunities, but there are two things on the demand side that I want to address particularly. These are public attitudes and global population growth. Conservation and energy efficiency are increasingly accepted by Canadians as appropriate modes of behaviour. But we must recognize that much action and public debate on energy issues these days, whether on EMF fears or CO_2 emission effects, rests on perception rather than fact.

What is needed is a reasoned, dispassionate and, most importantly, public analysis of the scientific and technological facts, as well as honest assessments of risks and benefits. New technological developments will be particularly subject to public debate. We must be vigilant to ensure that public perceptions do not result in withholding from the marketplace technologies that are, in fact, much more benign than those they replace.

This is not a scare tactic. This is happening in the pharmaceutical industry today. The energy industry must be alert to that. This places a special pressure on the energy industry, and on our scientists and engineers, to translate science and technology for public understanding, of both the facts and the implications for the total system in which energy is used

World population is a real driving force for energy demand. We're adding about one billion people every eleven years to world population, about 1.5 percent growth a year , leading to a

projected world population of 10 billion by 2050. Developing countries, with three quarters of the world's population, consume much less than one quarter of world resources, especially energy. So it's not outrageous to actually expect a three percent per annum growth in economic activity worldwide (Canada's growth is now about 1.7 percent per annum), with the lesser-developed countries taking the lion's share of that growth.

Let's assume an economic growth of about three percent per year and compound that annually. By the middle of the 21st century, we will have a tenfold increase in energy demand, or at least a tenfold increase in economic activity. That tenfold increase in energy demand of course ignores possible improvements in efficiency, hence efficiency changes are extremely important. But let's hold onto that tenfold increase number while we take a quick look at some of the environmental issues.

If we accept the scientific evidence that we're producing about seven billion tons of CO_2 a year and that we should not be putting more than about half of that, three and a half billion tons, into the atmosphere, that's the level at which CO_2 production was running at the start of the Industrial Revolution, then we have to halve our present CO_2 emissions. Combine that with a potential tenfold increase in economic activity by the middle of the next century in energy demand, and I think you can realize very quickly that we would need a target of reducing our projected levels of CO_2 emissions per unit of economic activity by a factor of **twenty**, i.e., to 5 percent of what we would otherwise be emitting.

If not, we cannot pretend to live up to the Brundtland philosophy of not mortgaging our future for the sake of today. This is an enormous challenge.

Now, of course, my description of environmental constraints is simplistic. I won't go into a lot of the details, but there are many other environmental and societal concerns about the generation and use of energy, such as:

- toxic waste emissions including heavy metals;
- ozone;
- water and air quality;
- waste management and site reclamation;
- the social and political dislocations caused by our dependency on and the manipulation of fossil fuels.

And I've made little reference to the efficacy of the use of manufacturing waste and by-products.

To contribute effectively to control and abatement technologies, much more must be known about how a pollutant released by a process or technology moves through the atmosphere, water systems or soil. What chemical, biochemical transformations does it undergo and how does it influence the broader ecosystem? This systems approach is an extremely important one. Technology assessment, the preparation of regulations and legislation, drafting of ethical guidelines; all of these require a solid understanding that goes well beyond the simple reductionist approach to science, one that looks at systems and the integration of the component parts of those systems.

To my mind, the biggest challenge, and therefore the biggest opportunity in the energy industry of tomorrow, is the integration of science, technology and innovation, with Canadian society, economy and culture. It means that we must empower Canadians to make informed judgments on how to deploy science and technology. We have allowed science and technology to become isolated from Canadian society, creating an apparent antagonism between energy and economic issues and the quality of life.

If this isolationist tendency is allowed to continue, attempts at rebuilding prosperity and well-being through science and technology will be for nought. Technology cannot be isolated from human values and aspirations. This means that society must come to terms with technology. This is especially true of such issues as nuclear power, hydrogen as an energy source and the use of fossil fuels in our transportation industry.

If we expect rational judgments from our citizens on the use of science and technology, there has to be a radical shift in our educational system to make scientific information much more accessible to all, not simply to the practitioners. What are the changes that we need?

I think they are threefold. Our youth must be provided with a capability of dealing with complex, multi-faceted issues including:

- Looking at systems; ecosystems, energy sys-

tems, industrial systems, rather than simply looking at pieces of that puzzle.

- To contribute to public dialogue, making scientific issues accessible for the public, especially such that there can be a much more effective and open assessment of risks and benefits.
- There must be a sensitivity developed to the global context, appreciating the pressures and opportunities that exist outside Canada's boundaries and the fact that we, as Canadians, have a tremendous energy capability that can contribute to solutions of world problems.

Surely, too, we can modify our national economic accounts to allow for both the positive and negative aspects of such initiatives. No one can be content with a system that blindly inflates GNP by the expenditure required, for example, to clean up a major oil spill, or which fails to count the implicit losses we incur when we decide to extract or harvest our natural non-renewable resources. We have to apply an appropriate cost to our energy resources and a cost in system terms.

What is now conceived as a 'Green GNP', is surely within the grasp of any country with a strong central statistical system, as Canada has, and appropriate economic and scientific talent.

In conclusion, I believe that we must, for our energy security, environmental sustainability and survival, choose investment in science and technology. We must embrace the principles of a conserver society but go beyond, well beyond, into an integration of energy issues into all of our lifestyles. But our goal can only be achieved in a knowledge-based economy, a society with a global outlook and one in which our scientists and engineers can contribute to the public debate. A properly educated population is the key to that intelligent stewardship.

Thank you.

Thanks by Einar Field: Thank you, Ms. Halliwell. You've provided us a broad perspective, outlined some of the alternatives available to us and explored some of the options on the horizon. We'd like to thank you very much for your presentation.

Developing an Environmental Awareness Through Education

Martin Hocking

Chemistry Department, University of Victoria

Introduction of Martin Hocking by Einar Field

In a real way the Brundtland Commission to the United Nations raised our understanding of how our collective actions for the next few years will have a major impact on this planet of ours. Our next speaker will address how we can contribute in a more informed and effective manner.

Martin Hocking is Associate Professor of Chemistry at the University of Victoria, and a member of the Metals Subcommittee of the National Research Council. His research includes industrial processes, emission concepts, pollution control measures, and brightening of mechanical pulps. He participates in the Cooperative Education Program and teaches courses in industrial and environmental chemistry.

Dr. Hocking received his doctorate in organic chemistry from the University of Southampton, and introduced and chaired the Environmental Studies Program at the University of Victoria.

Ladies and gentlemen, Dr. Martin Hocking.

Developing an Environmental Awareness Through Education

Thank you. Einar. Good morning, ladies and gentlemen. We have heard some excellent presentations amplifying the Forum theme here yesterday and today. Now, I am going to introduce something of a change of pace, by going from the very general to a very specific topic which is, as you will appreciate, necessary for a detailed analysis.

So, let's have a look at the title of my presentation. (Slide 1) This is to be an illustration of the importance of education in the study of the environment and, in fact, proper choices as regards the environment.

I'm going to compare two technologies. In order to accomplish this, as you will appreciate, one has to move to a very specific example. What I'm planning to do is give you, in as much detail as I can in 15 minutes, a detailed comparison of paper as a material for making single–use cups, as compared with polystyrene foam cups. (Slide 2)

One might choose uncoated paper, in perhaps an instinctive response, as being a 'greener' material than polystyrene for making single-use beverage containers. It is a long-held assumption that paper would be a better choice for this application. For polystyrene foam, here again we have to define it very specifically, because minor variations from this do change the balance somewhat. I've defined the polystyrene cup to be the moulded bead-type, the seamless type of light polystyrene foam cup.

First of all, let's take a look at the attributes of paper. (Slide 3). All of the following are well-known facts about paper. It is a versatile product. It's a natural material that is derived from trees and it has a fibre strength, due to the intrinsic fibres of which a paper sheet is composed, that is comparable to steel. The reason a paper sheet is not as strong as a steel sheet is due to imperfect inter-fibre adhesion.

From paper, we can make boxes that are lighter and stronger than wood, and in that sense, it is a highly desirable technology. We can make them waterproof or we can make articles that disintegrate readily in water, as our needs dictate. We can make materials that range from being as tough as the sandpaper used to smooth body–

work in automobiles to soft tissues that we can use in facial applications. And, of course, we're all aware of paper being the premier medium for information exchange.

But let's focus in a bit here on the amount of paper required to make 10,000 cups, 10,000 cups being a reasonable number to make the quantities in each of these categories an appreciable amount. (Slide 4) If we look, first of all, at the raw material needed, we find that for 10,000 polystyrene foam cups, we need something like 24 kilograms of petroleum as the raw material from which the plastic is made. For 10,000 paper cups, we need about 200 kilograms of wood. Now, to turn the raw wood into finished paper, we need petroleum, in the form of residual fuel oil or natural gas. For both technologies, as they stand at the moment, it turns out that we need to burn the same amount of petroleum for energy requirements to produce the two kinds of cups.

We need enormously more steam and power to make the paper cups than we do to make polystyrene foam cups. For the additional chemicals that are required in each of the technologies, it also turns out that we need far more additional chemicals to make the paper cups than we do for the polystyrene foam cups. So, as we go down this list, the only thing that looks about equal in environmental impact is the petroleum fuel requirement, and in all other respects, it looks like the polystyrene foam cup is somewhat ahead.

I should mention here, this being an Energy Forum, that both steam and the power used by both technologies is produced to a significant extent by co–generation, a technique for efficient utilization of waste heat. So that's the raw material picture.

What about the relative impacts of the manufacturing process on the air and water environment? Let's take a look at them. (Slide 5)

Here I should tell you that in our study of this comparison, we've looked at many more factors than the ones shown here. I've just summarized a few that are extremes either way to illustrate the point. First, water. If we look at the biochemical oxygen demand that's generated to make 10,000 paper cups, it's around one kilogram. For the polystyrene foam cups, only about 4/1000ths of a kilogram, or 4 grams, are required.

As for organic salts, which are the end products of the chemical usage in the manufacturing process for the two technologies, about ten times more are produced for paper cups than for polystyrene foam cups. Organochlorines produced in the bleaching stage of paper production run about 0.2 kilograms for 10,000 cups and none for polystyrene foam cups. Thus far, I have neglected to mention that one of the factors that certainly assists the generally smaller quantities of materials required and the emissions produced for a polystyrene foam cup relative to the paper cup is a consequence of their respective weights. The average weight of a polystyrene foam cup is about two grams for the eight fluid ounce size, whereas the average uncoated paper cup weighs about eight grams for the same size.

So the four times more weight of material required for the paper cup is certainly helping to push the paper cup figures to somewhat higher values than the polystyrene foam cup. But, as you'll see, many of the factors we've compared here differ by much more than a multiple of four.

So much for the relative discharges of the two technologies to the water environment. What about discharges to the air?

Chlorofluorocarbons, or CFCs, which are perceived as the major drawback of polystyrene foam cups, are a red herring. CFCs were never used by the vast majority of polyfoam cup manufacturers, and since 1987, are no longer used by any polystyrene foam manufacturer, so there is a null balance on both sides for that parameter. But since this is such a common public misconception, I felt it was important to mention it here.

Particulate discharges, as a result of combustion processes and some of the catalytic exchange processes amount to about one hundredth of a kilogram for polystyrene foam and 0.2 kilograms for the paper cups. The potentially more harmful components for polyfoam production are the styrene emissions, a volatile component created during the steps for making the plastic in the first place, and pentane emissions as a result of the blowing of polystyrene into a cup shape. Pentane is the agent usually used to puff up the beads of polystyrene foam and press them into the cup shape.

Comparison of the sulfur dioxide emissions of the two technologies shows a factor of about ten

in favour of the polystyrene foam. So here we have two or three factors that detract from the polyfoam and we have two or three factors that detract from the paper cups. But on balance, and without weighting any of the above factors, the two technologies come out somewhere near even.

What about use characteristics? (Slide 6) How useful are each of these products and how good are they at their job? That has also got to be a factor that's entered into choices of this kind. Here, let's look at the factors for the paper cup in the left–hand column and the polyfoam in the right–hand one. First, let's consider stiffness. As all of you know who have had a cup of coffee served to you in a paper cup, you have to be rather careful how you hold the paper cup, or you might end up compressing the cup sufficiently to spill coffee down your front. On the other hand, the polyfoam cup is somewhat more rigid and it maintains that stiffness even when it has hot coffee in it, because, unlike paper, polystyrene does not pick up water to any significant extent. So structural integrity, too, is a factor that favours the polyfoam.

However, a factor in usage that favours the paper cup is tensile strength. Here the paper cup, because of the better inter-fibre adhesion, has a higher tensile strength than a polyfoam cup in which the foamed beads do not bond to one another quite so well. This means basically that if you grab a cup by your first finger and thumb of each hand and pull it across at the top, you'll be able to tear a polyfoam cup apart much more readily than you will a paper cup.

The difference in use attributes means that if you move from a cup application to a plate application, a single-use or disposable plate, the paper plate would do a better job of resisting the cutting action of a knife than a polyfoam plate would. So even that sort of small change in end use can alter the use attributes of the two materials significantly.

For heat containment or heat retention, both cup types are very good. They will retain heat in the contents of the cup a lot better than a china or a glass equivalent because they have a low thermal mass. This being an energy symposium, you're all familiar with thermal mass and its importance.

Cup outside surface temperature? Here we have an advantage for the polyfoam cup, because of the insulating character of the foam. Freshly poured, nearly boiling coffee in a paper cup is practically impossible to hold without constantly shifting your fingers around to avoid burning them. Or you could, of course, ask for a second cup, and nest one inside the other to give more insulation. This would have the effect of doubling all the factors for paper cups in the comparisons with polystyrene foam cups.

Recycle potential? Well, I think this a vastly over-rated public perception factor favouring single-use paper cups over polystyrene foam. Recycle potential for paper in large volumes, where it won't be mixed with scraps of food and so on, is high. However, paper waste from a fast-food outlet comprised primarily of paper cups would not be an attractive recycle stream, but it still could be recycled. However, it is both possible and relatively straightforward to recycle the polystyrene plastic. It's much easier to get rid of traces of food and coffee and so on from polyfoam in a central recycling plant, because of the sink/float characteristics of the typical contaminants with which the plastic may have been discarded.

We haven't got as great an infrastructure for recycling plastic in Canada as perhaps we should, but it was announced just a week ago by the provincial government, that a general recycling plan will be instituted in the province for plastics. It is coming. Plastic recycling plants are already operating in Ontario and California.

After use, what do you do with a used coffee cup? Well, how about reusing the cup? If you wanted to go back for a second cup of coffee using the same paper cup, you probably could. But it's likely that it has already become quite soggy from the first coffee, and you may have some difficulty. A reused polystyrene foam cup, on the other hand, would have identical properties to the first cup that you had. So immediate re-use, re-use as opposed to recycle, is more amenable for the polyfoam cup than the paper cup.

Now, what do you do with a cup when you've finally finished with it? (Slide 7). I think the best method of ultimate disposal of either cup type is incineration, which, as we've heard already, has environmental merits over other disposal measures.

If either of these materials is burned in a

proper incinerator, properly fired, with sufficient contact time and at correct temperatures and so on, both paper and polystyrene materials can be incinerated cleanly. The polyfoam cup has an inherent heat capacity of about 40 megajoules per kilogram of material. Remembering that the foam cup weighs a quarter as much as the paper cup, however, we would only gain about half as much energy recovery on combustion for a polystyrene cup. So on that parameter we should give the edge to the paper cup for the amount of energy that you'd get per cup if you burned it.

If you dispose of these materials to landfill, here are the mass figures. The average mass on disposal per cup is 2 grams for polystyrene and 8 grams for paper products. Bear in mind that in a landfill situation, initial waste compaction and the weight of material in the landfill would compress the buried polyfoam to some extent. But we still find that the density of polyfoam, when discarded to a landfill, is about a quarter to a fifth of the density of discarded paper.

But while discarded polystyrene foam has a density of about one quarter that of discarded paper, and there is about one quarter as much mass of material to discard, it turns out that when you do the calculations the actual volume occupied by both cups in the landfill is similar.

Biodegradability? Again, I think this is a vastly over-rated parameter in the public perception. If paper does biodegrade in a landfill, which it would do if the landfill is in a wet area, it will contribute biochemical oxygen demand to any leachate. To deal with this feature in our local landfill, for example, we have to pipe this liquid through a treatment system before discharging it to the sea, in the same way sewage would be treated. Biodecomposition of paper in a wet landfill also contributes methane to the air.

Depending on what greenhouse model you choose, methane has between 5 and 25 times the 'greenhouse warming' effect of carbon dioxide. Is that a desirable attribute for paper? My feeling is that it's not desirable. At best, you could say it was neutral relative to polystyrene foam, which doesn't change at all when it is discarded to a landfill. But as we've heard earlier in this Forum, I would not recommend landfill as an ideal disposal option for either cup technology.

Litter? Well, paper, as long as it is an uncoated paper, would gradually disintegrate if discarded at the side of a road. Polystyrene would last much longer, maybe from ten years to perhaps as long as 50 years before it would break down completely, although its low tensile strength would mean that fragmentation would occur in a much shorter time. This lifetime would be a rather difficult parameter to measure.

Cost? Here we're talking about the wholesale price on a 1000 cup order basis. Paper cups for this application would normally cost around two and a half times more than the same size order of polystyrene foam cups.

This brings to mind another impact indicator. This is not a universal generalization, but a good indicator or guideline. If a product or a commodity or a use is less costly than another option, very often it will also have less overall impact, environmentally. I admit this is a broad generalization, but I've found that it is often true.

For example, if you were to buy a Chevy Sprint to get around town in rather than a Rolls Royce, I think there's little doubt that the lower-cost choice would also have relatively lower environmental impact as well*. A bicycle would have even less impact. But now, of course, use attributes would also have to enter the equation.

So, in summary, just looking at a quick survey of the parameters of the two cup types I think we could conclude that if the factors turn out to be similar then the choice is also nearly equivalent. (Slide 8) In other words, we should not discard polystyrene foam cups in favour of paper for instinctive reasons, but rather we should consider them as a further option. This aspect was pointed out by Janet Halliwell, our previous speaker, who recognized the importance of diversity.

Now, diversity is useful not only in genetic terms, but also in resource and product choice terms. Very often diversity improves the economy of overall resource utilization, and I think we should not forget that. So I hope this example has shown you that the best choice in this instance is not as black and white as the public may have thought in the last few years. (Slide 9)

What I've done here is give you what I would call an unweighted comparison of the two cup

*Speaker's disclaimer: No particular recommendation is intended for either product.

types. This is unweighted in the sense that I've just given you the raw numbers for each of the parameters we've looked at, as obtained from published sources. It is also important to look at each of these factors and try to decide, well, is this factor more important than that factor? It would be important to add that kind of refinement to the analysis as well.

I have not really done any weighting in this analysis at all. That would be a much more politically-charged kind of comparison to undertake. It is also a much more difficult comparison to do, and perhaps more subjective, so I have not attempted to do this. But, for example, site-specific factors could alter the choice that one makes here. If in one area, you are already recycling one product to the extent of 60 percent, and the other only two percent, that would obviously change the relative merits of the choice. (Slide 10)

Just to indicate that despite the public perception of paper cups being 'greener' than polystyrene foam, my review here suggests that we should take into account all the factors, not just one or two, in arriving at an informed environmental decision.

The paper industry has certainly become sensitive to environmental factors as indicated by printed logos like this on the back of a greeting card. (Slide 11)

Of course, an obvious suggestion that we should keep in mind, is that we should use china cups or mugs rather than paper ones or single-use cups of any kind wherever feasible. (Slide 12) But there are always situations where a single-use cup may in fact have a lower impact on the environment than a china one, for example, where there's a high risk of loss or breakage. So there will always be a place for some usage of single-use cups.

To leave you thinking about other kinds of environmental impact choices, let me just finish with a brief list of other trade-offs that could be examined in the same manner as I have done here for cups. (Slide 13)

First, the use of leather for shoes versus synthetic materials made from petroleum. Next, shopping bags made of kraft paper, versus the plastic bags; and here the weight factor certainly very heavily favours plastic again over paper. Reuse would reduce the impact of either choice. And garbage cans, made of galvanized steel versus plastic? Here, like with shoes and bags, I have to admit that I have not done a detailed analysis. But I'd be willing to bet that, over the long term, galvanized steel would have the edge over plastic in this application, just to show you that I'm not particularly trying to favour the plastics industry.

So let me finish on that note. I hope I've at least stimulated some thought that's going to generate questions in your minds about this and other choices after this Forum.

Thank you.

Thanks by Einar Field: Thank you, Dr. Hocking. You certainly provided a new and different perspective on the complexities of environmental decisions. It was a good demonstration of perceptions we may have and the reality that we gain through education. Thank you again.

DEVELOPING AN ENVIRONMENTAL AWARENESS

THROUGH EDUCATION

M. B. HOCKING

DEPARTMENT OF CHEMISTRY

UNIVERSITY OF VICTORIA

Slide 1

Least Environmental Impact

for a

Hot Drink Cup:

1. Paper, {Instinctive response
   {Long held assumption

   OR

2. Polystyrene Foam*?

* Moulded bead type, i.e. seamless

Slide 2

ATTRIBUTES OF PAPER

Versatile product

Natural polymer

Fiber strength comparable to steel:

- boxes lighter and stronger than wood
- waterproof, or rapid disintegration in water
- tough sandpapers to soft tissues
- premier medium for information.

Slide 3

RAW MATERIALS, 10,000 CUPS

Paper Cup		Polyfoam Cup
200 kg wood	Material	24 kg petroleum
18 kg	Petroleum	19 kg
840 kg	Steam	130 kg
80 kWh	Power	6 kWh
12 kg	Chemicals	0.8 kg

Slide 4

RELATIVE IMPACTS, 10,000 CUPS

Paper Cup		Polyfoam Cup
To Water		
0.9 kg	BOD	0.004 kg
5 kg	Salts	0.3 kg
0.2 kg	Organochlorines	nil
To Air		
nil	CFC's	nil
0.2 kg	Particulates	0.008 kg
nil	Styrene	0.05 kg
nil	Pentane	0.8 kg
1 kg	Sulfur dioxide	0.1 kg

Slide 5

Use attributes, recycle potential of uncoated paper vs. polystyrene foam hot drink cups

Property	Paper cup	Polyfoam cup
Stiffness, shape stability in use:	low	high
Structural integrity:	poor, especially when hot, wet	high, unaffected by moisture
Tensile strength:	moderate	low
Leak control, capped:	poor	good
Hot contents		
Heat retention:	high[a]	high[a]
Outside surface temperature:	hot	cool
Recycle potential		
To primary user :	possible, though washing or soaking can destroy	easy, negligible water uptake
After use :	acceptable: hot melt adhesive makes less attractive	good: resin reuse easy

Slide 6

Ultimate disposal options of uncoated paper vs. polystyrene foam hot drink cups

Property	Paper cup	Polyfoam cup
Ultimate disposal		
Proper incineration:	clean	clean
Heat recovery, MJ/kg	20	40
To landfill, Mass g:	8.3	1.9
Density , g/cm^3 (kg/m^3)	0.475 (475)	0.107 (107)
Volume, cm^3	17.5	17.8
Biodegradability, Landfill:	yes, BOD to leachate; methane to air	no, essentially inert
Re litter:	gradual disintegration	breakdown slow
Cost (wholesale	2.5x	x

Slide 7

Final Answer

If factors turn out to be similar,

then choice also near equivalent.

Choice seldom black and white.

Slide 8

Comparison of the Cup Numbers,

Unweighted Basis

Polystyrene foam, in this application,

is at least equivalent, if not ahead of paper,

in overall environmental impact.

Weighting could change balance, either way.

Slide 9

Cup example points up importance to consider

all the factors,	**not just one or two,**
e.g. Raw materials	**e.g. Chlorofluorocarbons**
Energy	**Recycle**
Emissions	**Biodegradability**
Utility	
Disposal/recycle	

to make an informed decision.

Slide 10

This product does NOT use any material from the World's Rain Forests. It's derived from sustainable forests where the replacement rate exceeds consumption.

OXFAM Card, 1991

Slide 11

To decrease the environmental impact of using disposable cups, participants are **required to bring their own mugs** for after-hours use.

Alberta
RECREATION AND PARKS

Recreation Leadership Programs
Summer and Winter
1991 – 1992

Slide 12

Relative Values

Shoes

Leather (Natural, renewable, biodegradable)	**vs.**	**Rubber, plastic (Animal rights, easy care)**

Bags

Paper		**Plastic**

Garbage Cans

Galvanized Steel		**Plastic**

Slide 13

Bringing Science Education to Life

Lon Mandrake

Past President, B.C. Science Teachers' Association

Introduction of Lon Mandrake by Einar Field

The students of today will be the consumers and decision-makers of tomorrow and no doubt the quality of their school environment contributes directly to their level of knowledge and long-term attitude. The quality of science education is a major concern both in the education sector and in industry. Bringing science to life is our next topic, and a very timely one. Our speaker is Lon Mandrake.

He teaches science and math at Seaquam Secondary School in Delta, B.C. He's a past president of the B.C. Science Teachers' Association. He is also the Vice President of the Society of American Magicians and has held several other positions in national and provincial teachers' and related committees and associations, as well as membership in several magicians' organizations. Mr. Mandrake has coordinated numerous teachers' workshops and magic shows. In 1990 he received the Distinguished Service Award from the B.C. Science Teachers' Association and the Excellent Teaching Award from the Ministry of Education. Please welcome Mr. Lon Mandrake.

Bringing Science Education to Life

Thank you, and good morning, ladies and gentlemen. I guess we should start off with a little magic. (At this point, Mr. Mandrake lit a small candle with his right hand, and placed it on the podium. Then he waved his left hand over the flame. There was an unexpected brilliant orange flash and a puff of smoke. Mr. Mandrake emerged from the smoke and flame, unscathed).

My topic is how to bring science to life. I've just demonstrated one way of doing it!

I've given this topic a lot of thought. One of the important things is to bring science to life for the general student, not just those that are already interested in science. Because those average students are going to become our future consumers.

I have a couple of concerns I want to share with you before I talk about how we can make science interesting for them. According to a recent U.S. science assessment survey, the average student's interest in science actually peaks at Grade 3, and when they're interviewed in Grade 8, they say that if they didn't have to take a science they wouldn't. That concerns me a great deal.

Also, from many sources, I've heard there will be a shortage of scientists and technicians in North America in the near future, and it doesn't look as if our universities and higher education institutes will be able to supply all the demand. Finally, the pseudo-sciences are as popular as ever. There was a recent survey asking students if they believed that there was some scientific evidence in things like astrology or graphology and a number of the pseudo-sciences, and over 80 percent of the Grade 12 students that were interviewed said, 'Yes, I think there is some scientific basis to them.'

When you run into things like Nancy Reagan's astrologer defending her various predictions by saying "Well, I use scientific astrology; after all, I put all the information into a computer and I draw it back out of a computer," so by using that technology we now have 'scientific astrology'.

You may not know this, but there are 20,000 professional astrologers in the United States and only 2,000 professional astronomers. And I suspect that the professional astrologers are better paid.

Unfortunately, many of our general public who have had science courses still seem to be fairly naive about the process of science and the

thinking of science. Why don't our students have a higher interest in science and why are they incapable of applying it to their everyday lives?

Well, for one, unfortunately, science is not considered by the majority of our society as rewarding to take as a subject, as a hobby or as a profession; the present group excepted, of course. How often have you seen 'Lifestyles of the Rich and Famous' on television highlight research scientists or electric technicians? It's much more glamorous to be a singer, a model, an athlete, and our books and magazines and television programs really emphasize this. Who wants to be a nerd?

Here's another thing. I found this kind of surprising when I first heard it, but when I looked it over, it certainly made sense, and that is that in a senior biology course, students are expected to learn more new words, more new vocabulary, than they would if they took a foreign language at the same level.

Also, it's a status thing that science be a difficult course. So I've heard a number of teachers say, 'Boy, I have very high standards in my physics course; 40 percent of the class are going to fail it.' It's also a status thing among students: 'Well, I'm going to take all three sciences because I've got a tremendous memory and it's really difficult.' This sort of idea permeates the schools, that sciences are very difficult courses, very demanding courses, and when you don't see a great financial reward at the end, a lot of students that might take it tend to draw away from it.

The exams are perceived as very tough as well. When I say perceived, I don't know that it's valid to conclude that they're harder than other courses but they're perceived to be so. Of course, most books, television shows and even cartoons portray the scientists as slightly mad and sometimes misguided, and he's just not really as 'cool' as teenagers want to be. Just to give you an example, in my Grade 10 Challenge class, I have the top students in the school and they were doing a project where they had to bring in a large display made by three or four students, set it up and explain it to the other students in the class.

These students really did a tremendous job. I mean, in the two classes, they brought in 20 displays, but they asked me, "Mr. Mandrake, could you be here at seven o'clock in the morning?" I said, "Well, I'm not usually there that early," and they said, "Well, we want to bring our displays in but we don't want any of the other students that aren't in the class to see them!" I guess they were ashamed of being associated with a science fair-type project at high school.

I found this a little disturbing because they were really great projects and displays and a couple of them actually went on to a provincial science fair after I'd talked them into it.

Those seem like negative notes. Now I'd like to give a little credit where credit is due. Our students in British Columbia, from results received in 1989 from an international assessment on education, ranked first in the world of those countries tested, in knowledge of science and in higher level thinking skills. Note this was done at the Grade 9 level. Our science teachers are held in very high esteem by such organizations as the National Science Teacher's Association and others. They're very involved professionally. I've been to a number of other provinces, and I've met with presidents of science associations in the United States, and as a group, we've got extremely active professional development.

A little later, I'll have some handouts. We have an upcoming National Science Teachers' Conference, which will be held in Vancouver in November, 1991, which will be a joint conference with our B.C. Science Teachers' Association. I also have some journals of our Association that I'll be pleased to show you after my talk.

Back to the topic: we can't do much about the salaries, the social acceptance or the media coverage of science. At least, I don't think we can do a lot about that in the schools, but we can do something to make it more interesting for students. Here are some ideas. These are ideas I try to use in the classroom whenever I can. Show students how science applies to their daily lives. Too often, the student thinks that, well, science is something you do in the this classroom; you put on your lab coat and safety glasses and then, when you leave, you leave them and science behind.

They don't see that you can apply the processes of science to everyday problems. I try to show them that it's a dynamic and exciting human endeavour that can be accomplished by anyone, not just an eccentric few.

Lastly, use other teaching strategies to allow students that have different learning abilities to become involved and excited about science, to feel that they, too, can be part of it.

The standard lecturing and reading of text materials is probably the most efficient way to get across a lot of information to a large number of students. Most high school science teachers in British Columbia probably have over 200 students that they have to teach and evaluate. It may be the most efficient way, but ,unfortunately, it can also be one of the more boring ways, especially when you look at the diversity of learning abilities we have in our classrooms. I have a few alternative activities that I use in addition. You know, we have to do the text reading, and we also do what I call recipe–type labs, which, again, I think, in moderation, are important. But there are a number of other things that address, I think, those three problems; how to show that it applies in their daily lives, that it is exciting and that it's an important human endeavour.

I have students do short reports based on newspapers, radio and television programs or public lectures. They write up their reports and discuss it in class, so they can see that the science they're viewing in the classroom or maybe some of the science that's not in the classroom is covered in the newspapers. It is around them...it's outside the classroom.

I have an overhead illustration of one of the assignments I give. Basically, it's to be a short report, and just for discussion purposes. For those very creative students, I have them find a cartoon and talk about its importance or how it relates to our science course, and if they're extremely creative, they can draw their own. (Figure 1)

I hope I don't have to interpret this one for you. We do nuclear energy in Grade 10. This includes an example cartoon for the assignment. I've heard of one teacher who asks his students, as a science assignment, to watch McGyver, which, of course, is a good role model for using scientific methods to overcome problems. I've had students write science–fiction on curricular science. For example, one that sort of stimulates interest in electricity is to propose that a group of aliens have landed on earth and they've completely zapped our present power sources. In fact, for some odd reason, electrons won't flow any more, but it doesn't affect life in any other way. I want you to write science–fiction based on what might happen.

It's amazing how they take and use technology or what they've learned in the curriculum and some of them really shine in the area of writing science–fiction. Again, as a result, they feel a little ownership in science. There's a reason for, say, the creative writing type of student, a reason for their learning about science.

Formal debates, I find, are an extremely good way to put across ideas. I think one of the most important lessons I learned from doing formal debates with my students was that in the beginning they said, "Well, I want to be sure that I get on the 'pro' side because that's the right side, and I want to get good marks." Afterwards, the same students would come up and say "You know, I never realized that there were so many points on the other side!" When I first mentioned debating, the students' ideas were that a debate means 'I'll out–shout you!' They see debates on TV where it's a shouting match, and the loudest person wins. Then they find that in a formal debate they have to present all their points, their valid points, and they're being judged on how logical they are. Then the other team states their points, and then they have a chance to dispute each other's points, so they have to listen to both sides.

We debate issues like abortion, the use of animals in laboratories, and alternative energy sources.

The class itself acts as the popularity judge, and then I also have other science teachers or perhaps an administrator come in and act as the official judges. Many times, by the way, the popularity poll comes in different from the judging poll, and that's an interesting learning experience too.

I mentioned the science projects. Now you have sponsored the 'Design Challenge' at this Forum. But not every student will necessarily like to undertake a science fair-type project. They may like to do a display on something they've learned. I remember one student who was doing quite poorly in science and we were studying energy. He built a model of a hydro dam out of Lego blocks and he had also drawn some pictures. The other students were impressed and asked him so many questions that he felt so good about it that

he actually got turned on to science and he went from a C-minus average to a B average.

I think it was just the fact that he was accepted, that he'd done well in this subject, so now his interest was reinforced. I think a lot of the problem is awakening interest. If a student is interested, they're going to do well. I think if you remember back to your own high school days, you'll recall that if you were interested in something, you did much better in it than if you were blasé about it. If you didn't think it was important, you could very easily block out your teacher's finest efforts.

I'm just going to summarize. By the way, I also use some magic and try to introduce some controversy or discrepant events to create interest. We might talk about that later in the panel discussion. But basically, there's four things that I think our teaching population can do, not only in the high schools, but at the university and college level, as well:

• First, is show the relevance of the science we teach to the daily lives that the students lead. I just have one quick slide to show you. (Figure 2). Now, what did you see?

Okay, did everybody see a clown?

Now, if you turn it sideways, you can see the whole circus. The dog there has got a ball on its nose. We have a unicyclist and a balloonist and the whole circus tent.

The reason I like this particular puzzle is that it shows that sometimes if we take a different look, a different learning style, a different teaching style, we can open up a more complete picture or a different picture.

• Second, show the relevance to daily lives, use a variety of teaching techniques. It's easy to get stuck with one method or your favourite type of teaching, or to follow the easiest type of teaching strategy. There's not just one way to teach science, there's not just one way to express science. Another teacher I know used poetry. The students went out, observed nature, and had to write poems on it, and that was their science assignment.

Of course, they had to show that they were good observers as well as being good poets.

• Third, create interest and curiosity as often as you can. I try to do this with puzzles, problems, magic. If you're not a magician, even a hobby will do. One science teacher I know is an avid fisherman and he brought in his hobby, pictures, etc., and all of a sudden the students were interested. So it doesn't necessarily have to be something as exotic as magic and it can be a hobby.

• Fourth, teachers should remain enthusiastic about what they do. That's probably one of the more important points. If you enjoy what you're doing, it rubs off. They say, hey, there might be something in it, because he seems happy with it. If you go into class looking glum, and you're not enjoying what you're doing they say, well, if he's not happy, why should I choose a career in that area?

So I hope there's a few things for you to think about. Thank you for inviting me. It's been a pleasure to be here.

Thanks by Einar Field: Thank you, Mr. Mandrake. You certainly have demonstrated that science can come alive. Without doubt, using your method of teaching science, we could collectively benefit, both as industry representatives and as individuals.

Media Report

Lon Mandrake

1. You are to choose a television program, radio program or attend a lecture (e.g., at Science World, the Planetarium, or the Vancouver Aquarium), and outline its theme in your own words.

You must include:

- the name of the program (or speaker),
- the date it was heard, and
- an evaluation of the program.

2. You are to choose a newspaper article, magazine article, or a brochure, and outline it in your own words.

You must include:

- the name of the article,
- the date of the article, and
- an evaluation of it.

3. You are to find a cartoon with a science theme or draw one yourself.

You must include:

- the cartoon itself, and
- a brief explanation of it.

This assignment is worth 20 marks.

Figure 1

Figure 2

Panel Discussion

Issues in Education and Public Expectations

Moderator: David Scott

Department of Mechanical Engineering
University of Victoria

Panellists
Janet Halliwell
Derek Henriques
Martin Hocking
Lon Mandrake

Introduction of Panellists by Einar Field

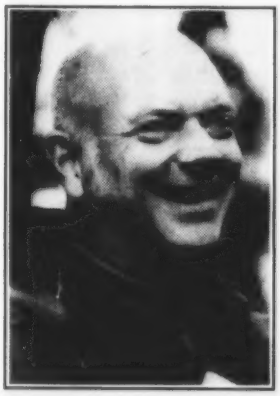
As you have seen from the printed program, during the remaining part of the morning, there will be a panel discussion and then we will have an opportunity to respond to the questions that you have sent forward to us.

At this point I'll ask the panel speakers to take their seats up on the stage.

The moderator for our panel will be Dr. David Scott. He's a Professor of Mechanical Engineering at the University of Victoria, where he teaches courses in engineering and energy systems. He's a director of the Institute for Integrated Energy Systems and formerly chaired the Canadian Advisory Group on Hydrogen Opportunities. He's working with the Government of B.C. and industry on strategies for developing hydrogen-related technologies and consults widely in this field.

In Ontario, Dr. Scott was Executive Director of the Institute of Hydrogen Systems where he guided research in hydrogen and fuel cells. Dr. Scott obtained his doctorate from Northwestern University in Mechanical Engineering and Astronautical Sciences. Ladies and gentlemen, Dr. Scott.

Issues in Education and Public Expectations



Einar, thank you very much for your kind introduction. I must say I'm honoured to be here and I have to say doubly honoured after I've heard the people speak that are on this panel. I think the Forum has been excellent so far.

A few comments as a 'speaker-watcher' getting ready for the panel; the title is 'Issues in Education and Public Expectations.' It is an excellent title for what we are doing.

Just recapping very quickly, Derek Henriques talked about cultural attitudes and ethics and how one nudges these into new directions that seem to be more suitable for today's world.

What he described is most encouraging: that is how a major utility, through Power Smart and other programs, is trying to influence behaviour. But it's also taking action. They're also putting their money where their mouth is. I think that everyone probably has a good feeling about that.

Next came Janet Halliwell. How can you recap her talk? But some things she said really stuck in my head, such as she felt we should emphasize the importance of systems analysis in environmental decisions. She said that systems analysis, that is, looking at the

whole thing, should complement, not displace, but complement the traditional reductionist approach technologists and scientists normally use.

She also made another important comment. She said we must make the critical ability to appraise concepts and systems accessible to the public. That was her phrase, 'accessible to the public,' not just accessible to the practitioners. As I was thinking about this, I thought my wording might be to get the public 'engaged,' to 'engage themselves in critical analysis.' I was thinking that it's a whole lot easier to not go through the hard work of critical analysis, when you are sitting in your living room watching a TV that is describing how the world is damaging itself. It's a lot easier to simply enjoy the warm fuzzy feeling of moral sanctimony that comes from adopting the TV group-think of what is morally correct. We know the dangers of that!

Martin Hocking told us that he was not going to worry about systems, he was going to look at a specific example. But as I listened to Martin, I realized that he was giving us a beautiful example of how, by looking at details, you can do a critical analysis of a system. In his case, it was analyzing one choice, cups. Our daily lives are filled with such choices. But the point is that rather than deciding from your hunches, or from technical magazines, religious convictions or whatever, Martin just showed us that this simple question, "What kind of cups to choose?", should be arrived at by careful analysis. I thought that his example was really useful.

To me, it's not so much whether we use styrofoam cups or paper cups, it's the methodology of critical analysis or choice that's important. You don't need equations to do it. You simply need to think out all the ramifications. I believe that was the most important issue that I came across.

Lon Mandrake: what can I say? I don't have a candle and I can't go poof, although many people might wish I would. When he said that a student's interest in science peaks in Grade 3, I shuddered. That is very frightening. It also gave me a funny feeling. Here I am, over 50, and clearly I haven't grown up. Science is still a lot of fun to me.

But beyond that, you can't encapsulate Lon's comments other than by repeating his talk. Lon gave us a lot of profound insights into the importance of science and ideas on how to communicate science in our high schools. To me the cutting edge of cultural change has to take place in our elementary and secondary schools.

After listening to Lon's talk, I thought the best thing we could do is to learn how to clone people and get a whole bunch of Lon clones out there quickly. But science is not quite there yet!

I have been asked to say just a few words of my own which I hope will focus on our 'polylogue,' as I'll call it, when everybody gets involved.

First, I note that this is an Electric Energy Forum. Janet and others have said that we must consider systems. So the electrical system should always be viewed within the holistic energy system. We must look at how the electric energy utilities can positively impact that full energy system. I'm going to show you two slides.

Here's the first. I think it's important to think of our use of energy as a system like that shown in Slide 1. This depicts an integrated energy system. The system is a chain of four components: energy sources, currencies, technologies and services.

Each component of the system is illustrated by examples from today's patterns of energy use. The source components are coal, natural gas, uranium and sunlight. Maybe I should have added hydroelectric for British Columbia. Or dung, for regions of India. But you get the idea. The examples aren't that important.

Energy **currencies** are something that most people don't think about. I find it vital to understanding the system because the 'currencies' allow the sources to be 'harvested'. In other words, you always harvest a source by making some currency. I've illustrated currencies by gasoline, diesel, hydrogen or electricity. An energy currency is analogous to a financial currency that enables financial transactions. In our case, the currency allows energy transactions.

Next, of course, you have the technologies. These technologies are the means of providing the end services.

Finally, the output, of course, is the services. The thing that I would like to make very clear is

that what people buy are **services.** They buy the ability to talk to wives, or children, or grandmothers by telephone. They buy, via TV, up-to-the-minute information on what's happening in the Near East.

Having determined the service you want, you next have to buy the technology that delivers that service. So If you want to send a fax, for example, the first thing that you have to do is to buy a fax machine from among the menu of technologies that are available.

Having bought the end service technology, a fax machine, you must next buy the currency. The fax machine uses electricity. Going back further into the system, you next have to decide how to generate the electricity.

To me, it is vitally important to see this system in its holistic sense, and not just focus on the components of the system.

You must also ask, "Where are we taking inputs from the environment at each point in the system and where are emissions returned to the environment at each point in the system?" Clearly there's little value in eliminating an emission of CO_2 at one point in the system if it simply reappears at another point.

Janet also posed the question, "How do we use sustainables, the sunlights, the hydraulics, the geothermals and that sort of thing, to drive B.C. Ferries?" She was identifying the fact that we're in a trap with oil for things like flying or driving. So one more problem is, "How do we move away from that dependence?"

Now the energy system obviously evolves in time. In the distant future one of the things that we are almost certain to see is that the currency component will be dominated by hydrogen and electricity.

But it is also interesting that in the same distant future, we don't know what the **sources** will be. Moving to technologies, we again have difficulty with predictions. But I would expect that fuel cells will become very important and that heat engines will be correspondingly much less important. British Columbia is nicely positioned with a major world manufacturer of fuel cells in Vancouver. Of course, the services in the distant future are almost impossible to identify.

I would like to show you a final slide to give a sense of timing, that is, the rate at which our energy system is changing. Slide 2 could take half an hour to discuss, but I'll only take a minute or two on it today. This is not our work; it's work done by the International Institute of Applied Systems Analysis.

The 'f' on the right-hand side is the fraction of the total energy market supplied by each source. These aren't currencies or technologies, these are sources. You can see that, over time, the share of energy contributed by wood is coming down in a world sense. Coal has gone up, peaked, and is now declining. Oil is probably hitting its peak now, and natural gas is still on its way up. A closer look at the last two decades is interesting, but I'll leave that because what I really wanted to show you was the rate of change.

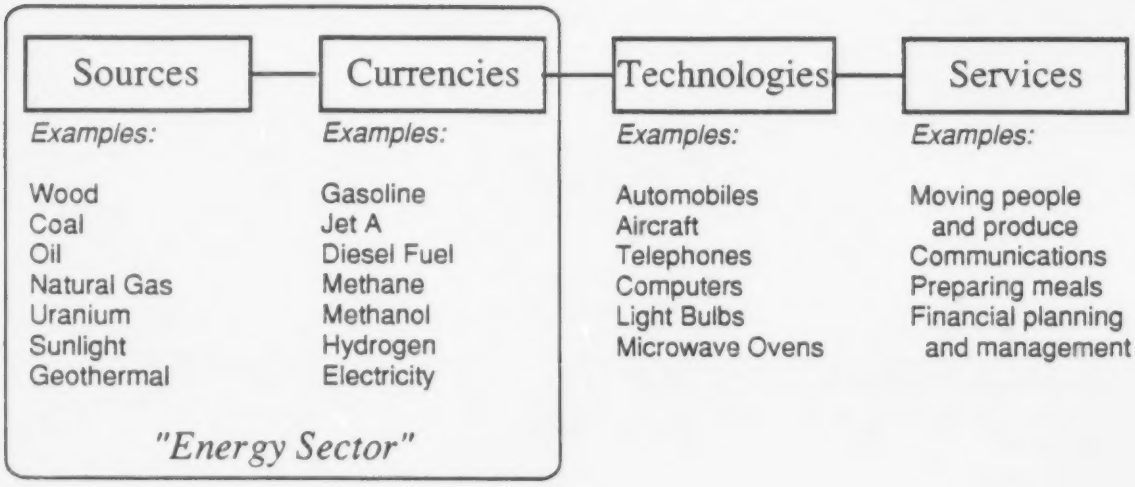
The rate of change shown for the future is unlikely to be slower than it has been in the past. It may even become faster. So look for natural gas to grow; there are a whole set of environmental reasons for it to keep growing. Look for coal use to decay. Look for a second-generation nuclear technology coming along, even though that may make some people apoplectic; I expect that the possibility of the renaissance of nuclear technology will come up later in the questions.

That concludes my contribution towards setting the stage for our panel discussion. I think the important issue is to engage the community: to engage the community in critical thinking about the **system.** Because I believe that we must do whatever we can to preserve and strengthen a culture of reason, that encapsulates things.

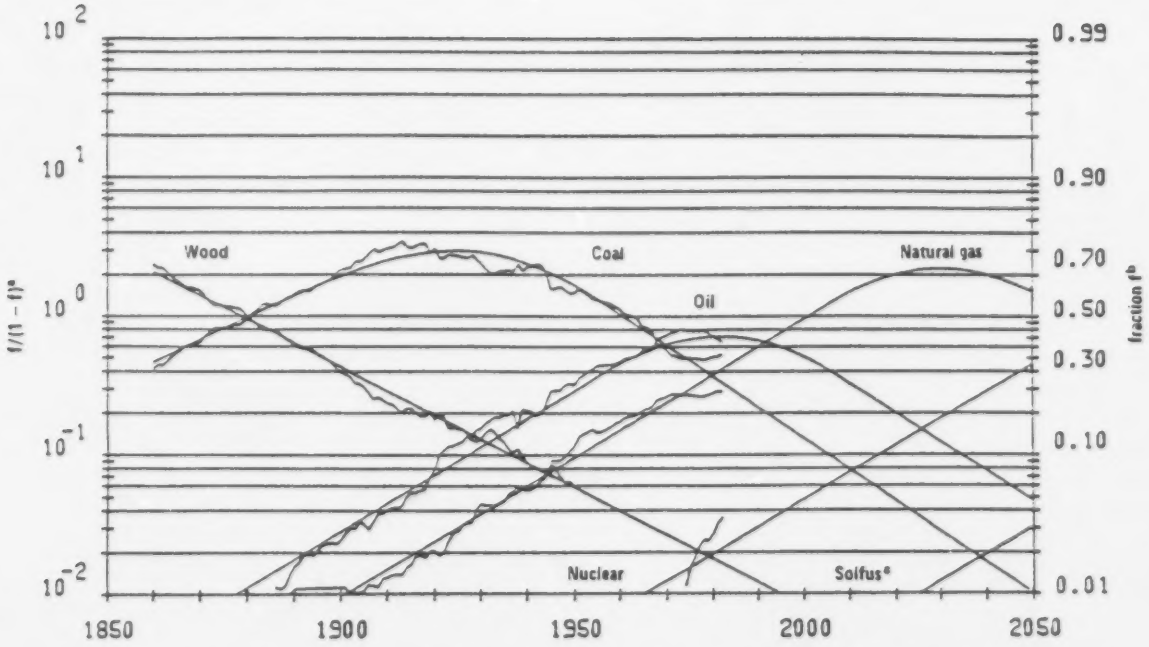
Other than that, it's been a lot of fun for me to be here, and I am really looking forward to our panel discussion.

Let me move to Janet Halliwell first. Here is a question for you, Janet.

"Journalists and other members of the media greatly influence how the public and legislators think about energy, the environment, science and technology. However, few journalists have extensive expertise in these areas. Would it therefore not be appropriate to mount some educational initiatives to enhance the expertise of journalists, and if you agree, what types of initiatives might you suggest?" Axel Meisen, Dean of Ap-



Slide 1: The Energy System



Slide 2: Market Shares of World's Major Energy Sources, 1961 to 2050 (Marchetti, 1985)

plied Science, UBC

Janet Halliwell: The issue of public accessibility is something which I've spent a fair bit of time debating with people. I think the key is to try to help our journalists convey a more authentic picture of the energy equation and the energy system. So yes, I do think that we have to move to providing our journalists with better tools, better access. Now, how to achieve that is a difficult thing.

I know that there have been initiatives by the Royal Society of Canada to actually train and expose journalists to some of the issues through their community. I suspect that that's not enough. Again I would come back to my comment that one may be looking at a diversity of methods. My sense is that every university should have an information office which will put journalists in touch with people:

(a) within that university who can help, or
(b) who can then direct the journalist to an appropriate source in Canada.

Some have said that the Science Council itself should act as a clearing house. With a staff of only 29, I can just suggest that life is already a little bit hectic there. The Science Council itself does act as what I'll call a broker, but I don't think it could go much further than just providing an information brokerage service. I would like to see a fair number of local initiatives, because I think that no matter what you do nationally, action takes place at a local level, and somehow the local journalists have to be put in touch with a national network of expertise.

That's where I see the universities as being a very important source, but my colleagues may have other comments on that.

David Scott: I'd like to observe that all panellists are welcome to participate in answering any question. So I'm going to go right to the end of the table and see if we can get Lon Mandrake to say something further. You must have thought about this, Lon.

Lon Mandrake: Actually I have given it some thought. It seems strange to me that a journalist doesn't necessarily have to have any background in science. In the schools, you go one way or the other; if you're a scientist, you're not a writer and if you're a writer, you're not a scientist. I think I'd like to see more journalists with science backgrounds. I don't think that this existing dichotomy is helpful.

In fact, there are some very good journalists who report on science. Perhaps there should be more encouragement to have scientifically-trained journalists throughout the media, and have newspapers offer a regular science column, for example.

David Scott: Anyone else care to comment?

Martin Hocking: I could add a brief comment. We have a Creative Writing Program at the University of Victoria and we also have an Environmental Studies Program. The way each of these is set up, students in Creative Writing, some of whom are heavily into journalism, can also take our Environmental Studies. In other words, they do gain some acquaintance with the kinds of environmental issues that they may well be reporting on. We feel that this is a useful thing to do.

David Scott: Are all brands of refrigerators that carry the Power Smart label equally efficient, and if so, what makes them different from those without the label? If not, then why is the B.C. Hydro rebate uniform, and why doesn't it reflect the degree of efficiency improvement?

Derek Henriques: No. All brands of refrigerators displaying the Power Smart sticker are not equally efficient. In fact, there is a threshold level they have to meet in order to get the Power Smart label. We are raising this threshold level as well, so that in a few months we will have another more stringent barrier in place before fridges can qualify for the Power Smart designation. That's going to coincide with provincial regulation of the efficiency of refrigerators. Essentially, the provincial government will be regulating the efficiency of refrigerators to meet the existing Power Smart level, that is, the current Power Smart level, by the end of the year.

David Scott: There was a general question, I think, addressed to Janet and to others, and I'll put it to Janet first. It reads: "Janet Halliwell seems to write off nuclear fission as a significant energy resource for the future. Why? Has the scientific community concluded that the nuclear waste and containment problems cannot be overcome?"

Janet, I'm not sure that you did write off

Janet, I'm not sure that you did write off fission. Maybe there's some confusion, but I'll ask you to respond to this question first, please.

Janet Halliwell: First, a caveat; I will offer only my personal opinion here and nobody should construe my remarks as anything formal in the way of an official government position.

I think nuclear fission is an absolutely essential part of the energy supply system. I'm saying that although I recognize that no energy source is totally benign; and nuclear power is no exception. In all cases, one has to look at the pros and cons of every energy source, and recognize that human demands on the power system some 30 to 40 years ahead, are going to be such that nuclear fission will be an essential source for us at that time.

I believe that the problems of nuclear waste disposal can be solved. I can't say they will be solved completely, but I think we will reach a point where we can lower the risk sufficiently. I've seen a lot of the work on immobilization of nuclear waste in glass and I recognize the immense amount of study being devoted to the stability of geological formations for long-term storage. In that regard, Canada, with its geologically stable Canadian Shield, has some very good sites for nuclear waste disposal.

There are some ethical issues and, in my opinion, one of the most important things is to foster a public debate of these ethical issues, and to put nuclear fission up against the pros and cons of all the other energy technologies. That's where the decisions must be made. So my own personal reaction is that nuclear fission is an important source of electricity which will become increasingly important.

With respect to nuclear fusion, just a reminder that I cannot see it being technologically feasible for 50 to 60 years. At that point it may well become feasible, and when it does, there may be some very interesting opportunities in hybrid systems between, for example, the CANDU system, which generates tritium, and nuclear fusion, in which tritium would be an ideal fuel. So one might eventually have some very effective hybrid systems. But now I am looking very far into the future, and much of that is speculation. There are many technological uncertainties and environmental issues that would have to be dealt with.

David Scott: Here is one for Martin. It says: "Given your presentation, do you think McDonald's decision to move from plastic packaging to paper was based on sensible scientific analysis or were they just jumping on a 'green bandwagon'?"

Martin Hocking: Fortunately, I was expecting that question. McDonald's own public announcements were to the effect that they made the change to paper in response to public opinion and that they themselves did not feel the scientific information warranted the change, apparently basing that on a study that they funded at the Stanford Research Institute in San Francisco in 1975, which more or less reached the same conclusion as I did with you this morning.

So consequently, expecting this question I went down to my local McDonald's. On the previous day, my picture had been in the Times Colonist, and the student who served me said, "Oh, you're Dr. Hocking, aren't you?" And I had to admit I was. Anyway, I ordered my cup of coffee and I said, "By the way, could you provide me with a sample wrapper for your 'Big Mac' and your 'McChicken' and so on?", which she kindly did.

I explained that the reason I wanted to do this was because I didn't want to buy a 'Big Mac' in the wrapper because the oil or juices could add extra weight to the paper when I did my analysis, and she understood that. Let me tell you, this is by no means an exhaustive comparison. But at least I can report that their new paper wrappers are half to slightly less than half the weight of the plastic foam clamshell containers that they formerly used. So in my view, that's a move in a positive direction, regardless of whether it's paper or foam, lighter being better, in the packaging truisms.

The only exception, which remains about equal in impact, is the new 'Big Mac' packaging, which now comes with a cardboard ring around the burger before its wrapped. The total weight of the ring and the wrapper is somewhere near the same as the old plastic clamshell, so I would regard the net impact of the new packaging to be about the same. But I don't think they've gone backwards. On the contrary, I believe that they are somewhat ahead in terms of environmental acceptability, as a result of their recent changes.

Derek Henriques. "What strategic research programs are planned by Power Smart?" I presume that means in developing new programs rather than the ones you've already discussed.

Derek Henriques: Our strategic research program will be focusing on the areas of technology which can reduce the use of electricity. Essentially we're focusing on all three sectors, residential, commercial and industrial. We've just drafted up a research proposal which we will be discussing with our research people, Powertech Laboratories, Inc., a subsidiary of B.C. Hydro. Right now, they do a considerable amount of research for us in testing products, to make sure that energy efficiency savings that have been reported are actually accurate, and we don't find ourselves promoting products that don't save electricity.

We want to focus on working with manufacturers to produce new products which will, in the long term, enable us to reduce our electric energy consumption by large amounts. For instance, we will support research by other groups. We try to leverage our research funding through the manufacturers, through other utilities in Canada, with the Canadian Electrical Association, and with other partners in industry who are prepared to combine our funding with their own research to facilitate a major impact.

David Scott: I have a question here which is directed to Janet. It starts, "I agree with almost everything said by Janet Halliwell", and goes on to ask: "But as long as we put in place governments dominated by businessmen, lawyers and promoters with vested interests in untrammelled growth, what can we do to create the sustainable world we know we must build?" F. S. Marsh

Janet Halliwell: I'll answer that by saying that politicians respond to what they perceive to be the interests and concerns of their constituents, so I think it's very important that we not pass the buck completely, rather that we each must accept a level of responsibility on this. There's no question that if one looks at the political systems in Canada one sees a dominance of people who come from areas other than science. But I would look at action in two specific areas.

First, education; in educating our populace, we have to both educate specialists, as practitioners of science and technology, and we have to educate the general public to understand and to be able to engage in debates on science and technology. So that is one approach, because it's only after we have that level of appreciation in the citizenry of this country that they can have their voice heard effectively by politicians.

Second, we've got to have more public dialogue, particularly on risk assessment and on new technologies. That's something which actually the Science Council has got to move into more aggressively in terms of areas of study and to try to change the way we do business in Canada. That comes, I think, to the political level.

My appreciation is that there's a real desire on the part of the politicians now to integrate science and technology into the decision-making process, but quite frankly they don't know how. The systems aren't there, and also there are confusing voices from the community. How many different voices have you heard on CO2 versus methane as the problem greenhouse gas?

Until we, as a society, manage a way of debating these science and technology issues effectively and get beyond the level of fiction and into some facts, recognizing there will be different opinions, I think we can't expect our political leaders to actually make the sort of judgments and decision-making that we want to be made.

Now, the other part of that question which I slithered past was the growth aspect. My sense is that growth, the pressure for growth, is as much caused by the Canadian citizenry, all of us, as by big businessmen and promoters, but that there is now a growing recognition of the need for what I'll call sustainability, and the recognition that sustainability may bring with it changes to the ecosystem. Sustainability is a difficult word because it means different things to different people, but I think that our politicians are increasingly coming to appreciate that.

So again, it comes back to us, ensuring we speak clearly, unambiguously and sometimes dropping some of the caveats on our comments so that the politician will truly understand what we need and what we want.

David Scott: I'll use my Chairman's prerogative and add a supplementary comment.

The question really was how can we get better government, and better politicians. I will

better government, and better politicians. I will say something which may be 'white-knuckle', but frankly, I have a lot of respect for politicians. Politicians do something which few of us are prepared to do in life and that is that they stand up in the public arena, and say where they stand.

Only one candidate wins, so there are a whole lot more losers than winners. Most of us try to arrange our lives to do our failing in private. I think politicians represent a mix of society, but my experience has been that most carry a dream of how they can help society. We might not like their particular dream, but they're prepared to stand up for it. So I would put the onus back on where it belongs, and that's on us.

We elect them. We elect these folks because they have said what we wanted to hear.

I think this brings us back to the position that critical analysis helps a whole lot. When you see wrong things happening on the political scene, when the evidence is there, the good newspapers will cover it. But we tend to overlook the good work politicians do, so my little plea is: please don't beat up on the individual that chooses to serve our society by running for office. Instead, let's look inwardly a little bit more to ourselves and to our ability to select the best candidate from those who offer to serve. Maybe that's too much of a speech for now, but I think it needed saying.

David Scott: I have one here for Dr. Hocking. "Given all we have heard about the imbalance regarding consumption of resources versus population would it not be an appropriate focus for us all to try to eliminate or significantly reduce single-use items?"

Martin Hocking: I touched on that in my comments earlier. Reduce single-use items? I would certainly agree that we should reduce or cut down the number of single-use items wherever possible, but just remember that it's more complicated than that. There are some instances where, if you ban single-use containers, you may actually cause more impact on the environment than if you allow single-use containers.

Let me give you a couple of examples. At a fairground, for instance, a vendor of soft drinks in a field could serve his soft drinks in glasses or he could serve them in one- or two-gram plastic or paper cups. It doesn't matter to the environment or me which one. But if one of those reusable glasses is thoughtlessly discarded or gets broken, it has an environmental cost equivalent to something like 100 single-use containers. If a child were to fall onto those broken pieces of glass and injure themselves in the process, then the injury would also have significant societal and environmental costs.

So I think we shouldn't ban single-use items but we should only use them where they may be appropriate. There are situations like that where the net cost of using reusable containers may in fact be higher than single-use containers. Those are the places where I think the option of using single-use containers should be retained.

David Scott: Here are two questions directed to Lon Mandrake. The first is: "Why is the teaching of science restricted to school classrooms?" The second is: "Why is the subject of science restricted to separate streams of classifications?"

I could maybe supplement that. I personally find it interesting that, for example, if you take engineering at a Canadian university, you are required to take a series of liberal arts subjects. But the converse isn't true. Frankly, I'm startled that the liberal arts graduates aren't required to learn a little bit about technology, which I'm sure would make their life richer.

Lon Mandrake: I think one of the problems is, when we talk about science outside the classroom, I guess its limited by the system itself and the money available. For example, it's very difficult now to take a class on a field trip somewhere. You have to get permission from the superintendent or, at the very least, from the principal of the school to take a class out. You have to then hire a substitute to come in and cover the classes you're not taking, because remember that if you're taking a group of 30 students or even 60 away, there are the remaining three classes of 180 or so that you would normally teach who also need to be looked after.

If you're taking the students out for the whole day, then you've got to talk to the other teachers that teach them English and French and Social Studies, because they're going to miss their students on the day that you take them away. I do it when I can, but believe me, it's a very difficult thing to take students out on a field trip.

What I'll do occasionally, though, is I'll take them out into the school yard for the hour that I get them and we'll do something out there related to biology or ecology. But as far as going off on a field trip, the red tape with it makes it very difficult.

Now for the second part of the question. As far as the classification of education streams, I think they're moving towards more integration, especially with the Royal Commission report; they're moving towards more integrated science and using science as part of the overall education scheme, not just as unique units of education. Actually, I feel it's a very good thing. I have to agree that we should try to teach a little bit of science in everything and show how it applies to all areas. It's a process of thinking.

David Scott: Here's another one for Lon Mandrake. "Existing environmental associations have, in some cases for 20 years, been the principal community educators. Would you consider giving them credit?"

I think that I could generalize that by asking "How can the environmental associations work with the more formalized education system?"

Lon Mandrake: Okay, well, the B.C. Science Teachers' Association is basically a volunteer group of B.C. science teachers that is looking at professional development, and how to improve science teaching in the province. We've also undertaken a number of projects for community education. There is also a group called the Environmental Educators: most of them are science teachers as well. Many of them are also members of the B.C. Science Teachers' Association and many of our members are members of their association.

As far as the B.C. Science Teachers are concerned, there's been a number of projects but there is the matter of finding the time. I mean, teaching is our main career, and to do teaching in the community as well, takes a lot of time and a lot of organization, and it's difficult.

I'm also aware of a few things that the Provincial Environmental Specialists' Association has done. I think it's important to go hand in hand with them. We're holding a major conference and one of the themes of this upcoming conference in November is the environment. I, for one, feel that the more input we get from all aspects of science education and industry, the better.

David Scott: Back to Janet. "Do you have any comments on Canada's commitment to R & D? If technology use is the key to environmental survival do you have any suggestion as to how the science 'community' can communicate its message to the public more effectively?"

Janet Halliwell: Two quite different issues, but yes, they are related. I think everybody knows that the level of R & D in Canada is low relative to most of what I'll call our competitor nations. There are many reasons for that, and people often decry it. They say, well, we should have a target for R & D. Some people may recall that I've been quoted as saying that things like targets are like bikinis, what they reveal is interesting but what they conceal is vital.

The structure of Canadian industry is such that we don't have the types of activities that are 'R & D intensive.' One can simply look at B.C. and the dramatic change over the last 20 years, dramatic change since the time I left in about '73, in terms of secondary industry. There is a restructuring of industry in this province but there has to be a much more major restructuring across Canada.

There are also issues such as our own expectations of what government will provide. I personally feel that there are some very serious problems underlying all of this. First is that Canada is better at recycling wealth than it is at creating it. That's why I believe firmly that we have to look at increasing our productive systems, and that's why energy is extremely important as an underpinning to that.

I think, attitudinally, the politicians are actually looking for answers and that if we as a society can give them those answers, it will be helpful. But let me flip to the other question, 'What can the scientists do?' Clearly, the science and technology community wants to communicate effectively with the political level, wants to look at the ramifications of what I'll call the low level of investment in R & D and R & D intensive activities.

I believe that as a country, we don't celebrate our successes enough. We have some superb things happening in this country. Why not highlight them? We should ensure that the politicians

know what's happening, where people want to go, and what will capture the interest of the students.

I think things like the electric car display, the fuel cell that's on display upstairs, these sorts of things, will capture the interest of people and can be translated for the politicians as well. So one of the things that I often advocate to the community is to 'take an M.P. to breakfast'. Tell him you can't afford lunch, take him to breakfast at McDonald's, talk about some of the science and technology issues involved in making choices, but also talk about some of the successes.

If you're a teacher in school or in a university, take along a student so that the politician can be exposed to youth. That actually is one of the very effective ways of getting a message across. Also, it means that this M.P., your local representative, may come back to you and ask you when they want an answer to a question about science and technology. That then puts an onus on you to ensure that good advice is provided. Don't ever mislead them. They won't come back to you again.

So those are the sorts of things that can be done. There's a real role here for trade associations, scientific societies and the like, to celebrate the strengths and to talk about the good things that are happening, to draw linkages that the politicians might not see instinctively. It also gives them something to talk about in the House, be it provincial, federal or even municipal.

David Scott: "What is B.C. doing to encourage students, especially female students, to enter science education? For example, at the primary through secondary schools curricula and at the post-secondary institutions?" And a second question along the same lines: "What should be done to get more girls into science and engineering programs?"

My wife would say call them women, not girls, but you know what I mean. Who would like to speak to these questions?

Lon Mandrake: Well, there are a number of organizations pursuing this problem. I know that the Ministry of Advanced Science Education and Technology are running programs, giving workshops on science in the schools and introducing role models to try to encourage more girls, sorry, more women, to the field of science. The Science Teachers' Association is very concerned with this issue and has put on a number of workshops for science teachers on how to encourage women to take further science courses.

I always found that some of my better students in, say, physics and chemistry, are the girls. Unfortunately, they often choose not to continue, because of social reasons and other factors, even though you can see their potential. So it's something that takes a lot of working at.

There is a society called SCWIST, Society of Canadian Women in Science and Technology, and they've taken a very active role. There's another group called APESE (Association Promoting Elementary Science Education) which looks at elementary science education and they have taken a role in this. Our own B.C. Science Teachers' Association has taken a role. But it's a complex problem. I mean, it's a societal problem. There's a number of things we are trying to do.

One thing I found in some schools is that the counsellors were discouraging young women from taking science. They were saying, "Well, you're good in science but you know, if you're looking for a job, you'd be better off taking typing or some business courses," and so on; and they were actually counselling them away from the sciences. I don't want to mention any schools but I talked to these particular girls myself and said, "Look, if that's where your interest level is there's a lot of opportunity, go ahead and take it, you don't have to be a secretary, you know, if that's not what you want to be."

Actually, we were talking about doing something with high school counsellors, a little program for them as well, on opportunities for women in science.

David Scott: This issue is so close to my heart that I have to make a comment. The first thing is that it may be a societal problem, not an institutional problem. But it may also be a societal opportunity. There is an extraordinary opportunity to engage women in the science and technology professions.

But first I have three quick supplementary comments I'd like to make at this time.

One, having been an engineering professor

in a number of schools, and teaching classes that get up towards ten percent women, this leads to a profound and good cultural change within the engineering class. One finds that the women who come in to engineering have done so not just because they could not think of something else to do (and besides, their Daddy was an engineer), rather, they never thought of doing anything else, and they've come in because it was their own deliberate choice. These women tend to have a stronger impact on the extracurricular activities and these sorts of things than the average male student. So if there's a message there, women in engineering do well and are a real asset to our society when they graduate.

Second, I should tell you that several years ago, Queens University in Kingston developed a program called 'Science Quest' where engineering students involved younger children from the primary and elementary schools in the community throughout the summer. That caught on so well in Kingston that other universities, not many, but some began to copy them. U.Vic has now started a similar program this summer and it has already been oversubscribed. There's a waiting list of 30 or 40 young people who want to come. I believe that the registration is around 50/50 male and female, so that's something that is working well.

Third, I've said we should look to ourselves. I am pleased to tell you that I have a daughter who is a graduate mechanical engineer.

Janet Halliwell: No parental pressure?

David Scott: No parental pressure at all, actually I must tell you. She said she wanted to go into Fine Arts and I said, "By all means, do what's fun. If Fine Arts is fun, go for it." She went half a year in Fine Arts and she came to me and said, "They don't know what they're talking about." She attended a seminar on energy, and announced, "I think I'll try something else." And something else was engineering! So there you are.

David Scott: A question to Derek Henriques: "B.C. Hydro recently had a public campaign to turn off unnecessary lights at 8:00 pm on a specific day. I never heard about the results except that there were 'significant savings'. How significant was the result and was it sufficiently advertised?"

Derek Henriques: Power Smart month was held in November last year and as David just told us it was designed to encourage as many customers as possible to turn off all unnecessary lights and appliances. We solicited business and industry, and we got a tremendous response. In fact, what we did to measure the response was to do an opinion survey after the event and this was based on random telephone calls.

The market researchers tell us that this is accurate to within four per cent 19 times out of 20. Now, I'm not a market researcher and I don't particularly understand how they do it but the response was that 51 per cent of the population participated to some extent. Now, if that relates to a single 100-watt light bulb for, say a half a million of our 1.2 million customers that would be in the order of 50 or 60 megawatts.

So that is a significant amount and it just goes to show what can be done if we put our minds to it.

David Scott: Another question. "Cloning people like Lon Mandrake is not possible. True, however, we might find mechanisms to clone his expertise. Could we, for example, institute a Master Teacher award that freed the recipients to travel through the B.C. schools and coach science teachers, and provide a direct inflow of ideas and energy? This would help us celebrate success and achieve desired results. Who could possibly support such a venture?"

Lon Mandrake: I think it's a very good suggestion. But I'm just not sure how we would get funding. Is anybody from the Ministry of Education here?

Actually, we try to achieve these objectives at our conferences. We try to get the best science teachers to come and give of their expertise. The only problem is that not all science teachers can attend a science conference and when they do it's maybe once every few years. It's extremely stimulating to come back feeling you can move mountains, but these events are rare for the average science teacher. So an idea like that would be an excellent one, you know, to have roving teacher workshops to work with other teachers. I wouldn't say only science teachers, but maybe all areas of teaching. But I'm not sure where the funding would come from.

David Scott: Okay, while I've got Derek

reading another question, I'm going to trick him by asking him one that he hasn't read yet. "Why is there no electrical energy produced at the refuse plant in Burnaby which is operated by Montenay, Inc. for the GVRD?"

Derek Henriques: I don't know if I'm qualified to answer that question. As far as I know it does provide some steam for a mill adjacent to it.

Is there anyone here in the audience who could add some information in response to this question?

Voice from the Audience: I could add to that; two-thirds of the steam raised is used in the adjacent industrial property. Another third is rejected to the condenser, at low pressure, at about 400 psi; and I expect that's why the question was asked. I believe that H.A. Simons did a study of the feasibility of using the rejected steam to generate electricity for the GVRD. As I understand it, the GVRD couldn't get an economic return on this, probably because it would need some superheat to run the turbo-generator.

Derek Henriques: Thank you very much.

David Scott: Another question. "The distance between the 'average' citizen and scientists is not the citizen's making. For years there has been a sense of superiority displayed by scientists in educational and public settings. The view of the average citizen has not been perceived to be important. Suddenly it is. What can be done to fill this gap?"

I direct this question to you, Martin, because I think the sort of work that you're doing is an outreach to the general citizens.

Martin Hocking: First of all let me say I sincerely hope I haven't given you delegates an impression of a sense of superiority. That's certainly not my nature, as anybody who knows me well realizes.

How to bridge the gap? Well, I think that ties in to one of the answers given earlier to a question about educating media people and being accessible to media people. I can say, from my own experience, that from the scientist's perspective it's much easier to keep your head down and not respond when a reporter or a media person calls. But I have generally tried to respond whenever time permits. If I don't know an answer to a particular question that might be directed to me, at least I try to suggest someone else, perhaps in the university community, or perhaps in the industrial sector, who could respond.

So I think that's the way scientists as a whole can help to improve the lack of communication, if you like, between the average member of the public and science as a profession. Scientists have to be responsive to the media and to try and help the media to keep their information correct about the events that they are reporting. Perhaps some of the other panel members would have things to add to my comments.

Janet Halliwell: I might just add one comment. Looking at Canada relative to the U.S., even given the difference in scale, I think the communication problem may be exacerbated by the lack of what I'll term 'popularization magazines' for science and technology in this country. We don't have a 'New Scientist' or a 'Science' or a 'Nature', something in which the science and engineering community can actually try to translate their work into popular terms and something that others can actually pick up and read.

That, in turn, makes it more difficult for the journalists, who, in most cases, are writing in isolation for local newspapers. Ideally, that's something that Canada should have. We tried before with a publication called, I think, 'Science Dimension', but it didn't work. Maybe it's time to try again.

David Scott: A question for Lon Mandrake. "What would you like to see in a curriculum assessment guide for the junior high school level science course? (or late intermediate, in current terminology), especially in light of the 'systems considerations' raised by Halliwell; in light of the 'Power Smart conservation considerations' by Henriques; and the 'considered choices to be made' raised by Dr. Hocking."

Lon Mandrake: Well, I think in any science curriculum, the teaching of the scientific method and of critical thinking is essential. We should make science user-friendly and show students it can be applied to everyday problems. One of the problems that's been brought up is the fact that a lot of the general public might see science as way out of reach. They hear the esoteric vocabulary often used by scientists, and it's almost like a

foreign language, so they're intimidated by it.

At our 1989 Science Teachers Conference, the theme was making science user-friendly, to make science more available, to look at the process of applying science to everyday life, to debating issues and so on. I'd like to see a lot more emphasis on the processes of science, so that if people are interested, they won't be afraid to pursue it and learn more about it. They won't feel it's untouchable and that only a very few people can do it.

So, rather than a specific curriculum guide, I think that we should teach them the processes of science, how to think scientifically, how to think critically, and how to take information and evaluate it. I think if we do that, we're doing a very good job with our students.

David Scott: The next question reads, "The amount of energy available in the world is limited. How do we rationalize increased population?"

I guess the first thing to observe is that the amount of energy per se in the world is **not** limited. Let me explain that observation in a couple of ways.

In a very simplistic way, you can think of our planet earth receiving electromagnetic radiation coming in the from the sun, a certain quantity of energy. Now energy also goes out from the planet earth as electromagnetic radiation to the universe. These amounts of energy are almost equal, because there are a few things like tidal friction, and geothermal heat losses, etcetera, that upset the balance slightly.

So you have energy coming in and you have energy going out and it's essentially the same amount. So we're not using energy on planet earth like we eat up bread or something like that. In other words, it doesn't go away. There's a continuous supply of it.

I want to say something about fossil fuels. We said we were going to argue with each other on this panel, we haven't argued yet, but let me just make an observation. Janet said that we have 30 years left of certain categories of fossil fuels. She accurately quotes what officialdom says. The reality is that we can't possibly use the fossil fuels that we've already identified in planet earth because we could not tolerate the associated buildup of CO_2 in the atmosphere. There is no meaning to running out of fossil fuels because of depletion.

But there is a very real meaning to capping the use of fossil fuels because of environmental damage. The analysis can be done very easily. You just count the carbon atoms that are still in the ground and say what would happen if they all went into the air? You would have an uninhabitable planet, that's what you'd have. So we will be moving off fossil fuels in the fullness of time but it will not be because of depletion, it will be because of other reasons. Regionally, they can be depleted, of course.

Another thing that is curious; remember we were talking about what we buy is the service: that is, the ability to move from Victoria to Toronto or Ottawa like some of you will have to do to return to your homes. Goodness knows why anyone would want to live in those places, but that's beside the point. We have in our mind that we can effect that transfer by certain means. In other words we do it by airplanes, and so let's make airplanes more efficient, and you realize that you can only make them efficient up to a point.

It's interesting to know, and I've done a fair bit of thinking about this. What is it in transportation that we really need energy for? Interestingly, in the limit, you can show that in most cases, you need either trivial amounts of energy or zero to provide the necessary energy services.

For example, if you want to go to Ottawa you could, in principle, bore a straight hole from Victoria to Ottawa. Rather like making a hole in an apple with an icepick: a straight hole just emerging at two points through the skin. Then you evacuate the hole. Now, although the hole starts out parallel to the earth's surface, it gradually gets further from the surface, reaching it's maximum depth halfway. Next, you could get yourself a little capsule on tracks, and you slide downhill. Because the hole is evacuated, there's no friction losses. You would build up speed all the way to the bottom, coast the rest of the way and you'd come to a stop in Ottawa. You'd have used no zero energy, except for the difference in elevation. Maybe you could climb the last bit to Ottawa on battery power and then recharge the batteries on the return trip to Vancouver and sea level.

You can go through a lot of 'thought experiments' like that and realize that there's no fundamental law of nature that requires that we use vast quantities of energy to go from A to B.

As we're talking here today it's clear that the system is getting more and more efficient. That's the thing to concentrate on, efficiency, not some kind of non-thinking blind energy conservation. Efficiency, that really is the issue.

So if we think about population growth, theoretically, and with advances of technology, energy systems are no constraint to population growth. I think that there are a whole lot of **other** reasons to constrain population growth, but not because of energy 'running out'. Even though, right now, our energy systems cause major environmental impact, in the limit, energy is not going to restrict population growth at all.

I don't know if others want to comment on that because I've said some 'white-knuckle' things here.

Janet Halliwell: David, I'd merely say you're sounding more like a theorist than an experimentalist!

David Scott: Let's go on to the next question. "How more efficient can we make the electrical system?"

Allow me to try and answer this one. In the fullness of time, the electrical system will get more and more efficient. Let me illustrate by looking back at the OPEC oil embargo of the 1970s, when the world tried two responses.

One response was to rush out and drill a whole lot more oil wells. The other was to introduce more efficient systems, like cars that go further on the same amount of fuel, etc.

Now, the oil people that drill holes in the ground went out and drilled more holes. The automobile people got to making more efficient automobiles. Others made more efficient light bulbs, more efficient windows.

What's happened? You can look at the world as having a competition between more energy at higher cost, or improved and more efficient technology. It's the improved and efficient technologies that have won and will continue to win. That's really what I have been saying, and we will keep moving that way. That's enough, I'll stop.

Janet Halliwell: Yes, I think though it's important to note that, and although I agree with you about the ultimate limits, I think there are some fundamental barriers, in terms of actual access to those energy sources. There are some major ones, and fusion is one such example, of how do we access the energy that is inherent in atomic fusion that we have to come to grips with.

Another one is the theoretical efficiency of the combustion engine; we come down to the Carnot cycle. It's limited by the combustion temperature, and how low you can get the exhaust temperatures. If you can double the operating temperature, you might be able to extract a lot more energy out of that system, i.e. increase efficiency. There are some fundamental technological barriers that have to be tackled, and that's where the opportunities lie.

David Scott: Well, I hope Geoff Ballard is in the audience with his fuel cell, because that's one of the ways.

Here's the next question. "Raising electricity rates may well be an important conservation ethic, as you suggest, but what happens to the economy of our country if we're overpricing one of the few major assets that we have, which is low-priced energy?"

Derek Henriques: I don't believe that it's necessary to price energy so that we're not competitive with other industrial countries. I think what B.C. Hydro is proposing is to alter the structure of the rates rather than increase the actual price of the same amount of electrical energy, so that there will be an incentive to use electricity more efficiency.

You have to balance economic development and energy use and I don't think it's a cut and dried issue. It's one where you have to perform a very careful balancing act.

It's up to our rate analysts to figure out the most appropriate way to do it without making a major negative economic impact.

Janet Halliwell: Talking about electric energy rates, I think we have to recognize how low our electricity rates are in Canada: about 5 cents a

kilowatt-hour in Ontario versus 25 in Japan. That's the rate the consumer pays. But in Japan 2 percent of that larger cost is ploughed back into energy R & D; whereas in Canada we're looking at only 1 percent of sales put back into R & D.

In Japan, an additional 2 percent tax on electricity goes to support research on energy in the national interest, and that can be energy efficiency in manufacturing processes, etc., and then on top of that, there's an additional 1.6 percent tax on revenues, making the total 5.5 percent. Much of the latter revenue goes to an energy association that in turn funds electrical energy research, as our own Canadian Electrical Association does here in Canada.

The difference in scale is dramatic; and this is what is driving the Japanese system to become very energy efficient. At the same time a lot of that research money is going into the environmental side as well, so that you're attacking both the efficiency and the environmental sides simultaneously. So pricing is a complex issue.

David Scott: I'm going to change our panel's mode slightly. I'm going to start at your end, Lon, and ask if you have a sentence or two about things that we might have missed here, just to sort of recap. Then we'll work our way up the table.

If not, then I'll ask another question from the audience, directed to Lon. "Have you thought of using community resources such as industrial professionals as guest lecturers on applied science from the 'real world'?"

Lon Mandrake: Yes. Yes, I have, and on a number of occasions I have brought speakers in to talk to our classes. Even better is to bring in a dynamic speaker to address a whole auditorium at a time. The 'Science in the School' program is trying to address that, although I think it's being used mainly outside the Lower Mainland but, yes, I have thought of it, I have done it, and I think it's very worthwhile.

David Scott: I'm going to go to Martin and put the onus on you for a last-minute thought.

Martin Hocking: Well, to digress briefly from the basic theme, which is energy; I'd like to point out something that as a chemist and I suppose chemical engineers would also appreciate, and that is the inter-convertibility of oil or natural gas as energy or as a raw material for products that we all enjoy. This shouldn't be forgotten, and that as we consume oil as an energy resource and gain the work output, we have nothing left at the end of it; whereas when you use oil or gas to make products, these can be recycled and reused many times.

As one example, global fibre production currently is roughly one half from oil, or gas-based synthetics, and roughly one half from the traditional natural fibres: cotton, wool, linen and the like. Were it not for the oil-based synthetics providing clothing for the world's population, we would either have to devote a lot more arable land to grow fibres instead of food, or we'd be less well-clothed than we are. We would have to face one or other of those choices.

Dr. David Scott: Thank you. Derek, any last thoughts?

Derek Henriques: I'd like to say that there is an abundance of energy-efficient technologies available throughout the world which are shared by all countries through various electronic means, through libraries and so on. We know about all the technologies that are available around the world. I think the major issue is the individual decisions of each and every one of us in participating and making use of these technologies.

Once we have information available to us, and once organizations like ours can distribute information to all of us as consumers, then we have the ability to make informed decisions when we make choices, such as designing new buildings or installing lighting systems or buying new appliances. I think that the real emphasis should be on the making of individual decisions rather than on the technology, because that aspect I think is relatively mature.

Janet Halliwell: I've probably talked enough already, but I'd like just to come back to one thing which I mentioned in my opening remarks, and that is the apparent antagonism between technology and society. I think it's extremely important that we all work to harmonize our differences. I just wanted to quote something that I didn't include in my earlier comments and it's something that came out of an OECD report a couple of years ago. I liked the words. It describes the interplay of technology and society very well:

"Technology can be defined as a social

process which, by meeting real or imagined needs, changes these needs just as it is changed by them. Society is shaped by technical change and technical change is shaped by society. Technical innovation, sometimes impelled by scientific discovery, and other times induced by demand, stems from within the economic and social system and is not merely an adjustment to transformations brought about by causes outside that system."

I think that's an incredibly important message.

David Scott: Here's a good question to end with, directed to Derek; "How long will Power Smart remain the number one resource option?"

Derek Henriques: I would say Power Smart is our number one resource option and will remain our number one resource option until every individual makes the decision that all possibilities for energy conservation have been exhausted. I don't think Power Smart will fall from that position until we have taken every step possible to make it happen.

David Scott: Thank you all very much. That wraps up our Panel Discussion for this morning's session. I've enjoyed chairing the Panel.

Thanks by Einar Field: Our appreciation to Professor Scott and his panel for a very interesting morning and for helping the Forum on to a positive start. We will continue with interesting speakers in the afternoon, and then we'll break for the group discussions. I'd like to encourage you to participate in these group discussions. At this point, we are going to break for lunch, which will be held in Salon A upstairs. We'll try to reconvene back here at 1:40 pm, so we'll see you then.

Questions Answered by Janet Halliwell after the Forum:

Question: As you have pointed out, the intellectual basis for technologically-supported conservation existed at least 16 years ago. The rate of spread of that knowledge into the societal mainstream is slow, and appears to be regulated by dynamics similar to the spread of contagious diseases. From epidemiology, we have learned how to slow such spreads, but maybe not how to speed them up. In order to implement 'intellectual stewardship' and speed the spread of attitudes and knowledge, we need to identify some 'intellectual interventions'. Can you suggest some specific actions?

Janet Halliwell: Any meaningful strategy for intellectual intervention must recognize the fact that there are a diversity of groups that must be targeted with accurate and accessible information, e.g., business, the financial community, consumers, politicians, even extremist environmentalists. What is an appropriate form for one is not necessarily the same for the other. However, in my opinion, the three most urgent targets would be:

- **Economists & financial planners:** To promote a change in the economic paradigms that 'value' the treatment of waste and pollutants more highly than prevention.
- **The general public:** To convey what 'sustainability' really means in terms of long-term investments, i.e., there is a cost to be borne, and to discourage short-term 'fixes'.
- **The politicians:** To promote a long-term approach at all levels. This won't work unless the strategy is successful with the first two target groups.

Without these, commitment to intellectual stewardship will be slow, and progress even slower.

At the same time as tackling the short-term issues, an appropriate change in the educational system is required, as indicated in my talk, to mitigate against future generations repeating problems of the past!

Question: It is evident that politicians do not want to integrate science and technology into political decisions in view of the pathetically low budget that Government allocates to research. What is the Science and Technology Council doing to improve the situation? Or don't you

have the clout, as most advisory councils don't, to really influence Ottawa?

Janet Halliwell: Canada's low investment in Science and Technology (and it **is** low) is not the result of a low government investment in research per se, rather our low GERD/GDP ratio is an after-the-fact indicator that this country, as a whole, has not recognized that the key to prosperity and a high-wage economy is increased investment in knowledge-intensive products and processes, and a move from simple extraction of our natural resources without upgrading. A healthy economy would automatically engender a stronger R&D performance, but increased government investment would not necessarily drive a healthier economy.

For the record, government performance of R&D is about average; university performance is slightly below average and industrial performance is **far below** average in comparison to our major OECD competitors. This does **not** mean the status quo is acceptable with respect to science and technology-related activities of federal or provincial governments. One must look at the whole infrastructure for innovation and R&D, including tax incentives, other financial incentives, and intangibles (e.g., the availability and cost of capital) as well as the quality and effectiveness of our universities, the competitiveness of our industries, and the role of our government laboratories. These are all under review by the Science Council of Canada or other bodies at present. The role of the Science Council is to pull the various facts and assessments together to provide an accurate 'report card' on Canadian mobilization of its science and technology (S&T) capabilities.

The Science Council of Canada has a mandate to advise and catalyze public dialogue on S&T-related issues. Our activity level and our visibility is limited by a very modest resource base, but our 'clout' comes from our functioning as a dispassionate analyst of S &T, not an uninformed advocate for extremist action. Our current projects, projects that involve three different aspects of the health care system, sustainable agriculture and an examination of the technology strategies for 15 sectors of the Canadian economy, and those of other players, such as the Association of Universities and Colleges of Canada, should provide us with an improved knowledge base for providing good advice across Canada over the next year. Ultimately, however, it is others, the decision-makers and opinion leaders who must **use** the work of the Science Council to change the system.

Question: There is a fundamental concern for the environment underlying this Forum. It seems, however, that perceived research needs focus on alternate energy or in improving efficiencies. What can we do to ensure that our responsibility for mitigating and cleaning up the environment as a result of past developments is facilitated and speeded up? Do we not need more commitment to life science research and broader educational programs? Will this be enough and will it be fast enough?

Janet Halliwell: It is understandable that the Forum focused primarily on reduction of environmental damage at source, through reducing energy demand by changes in attitudes and efficiency of technologies or through the use of less invasive technologies of energy production. Clearly there is also a need for environmental clean up, but the long-term problems will be less if we tackle the issues at once.

In my opinion, what is most needed in terms of environmental research is developing predictive tools for looking at integrated ecosystems and their response patterns when challenged by external stress. Such tools are needed for assessment of new technologies **and** for environmental clean up. However, until there is a broader recognition by citizens and politicians that environmental sustainability is a legitimate cost on society, that collective societal interests must take precedence over individual benefit, and that long-term vision is paramount, no amount of research and education will achieve the desired goals.

Questions Answered by Derek Henriques after the Forum:

Question: What is the total budget for Power Smart? Bob Wyman said $375 million, but I have seen figures as high as $600 million.

Derek Henriques: In January, 1991, our former Chairman, Larry Bell, announced that the Power Smart budget was being raised to $600 million over 20 years. This reflects the increase from the original energy savings target of 2700 million kilowatt-hours (Kwh) to 5600 million kWh by the year 2010. As Mr. Bell said then, "Conservation is an investment in the future. It's no different from building a major capital project in

that it takes major funding." The $375 million figure may have referred to the budget over 10 years.

Question: What is the make-up of the Power Smart organization?

Derek Henriques: This June, Power Smart became a Strategic Business Unit, reporting to vice-president Chris Boatman. As a Strategic Business Unit, Power Smart has the same status as other key operating functions within B.C. Hydro.

Question: Will B.C. Hydro be seriously addressing the possible health hazards of electromagnetic fields produced by cable electric heating systems and the psychologically disturbing aspects of monochromatic light such as high-pressure sodium vapour lights? Will this information, both pro and con, be actively presented through your educational programs?

Derek Henriques: B.C. Hydro takes an active interest in health-related issues and does research and testing on these and other areas.

First, on the cable electric heating systems, our preliminary investigations show that modern systems generate relatively low electromagnetic fields, comparable with overhead fluorescent lighting. No health hazard has been found. We feel it is the responsibility of manufacturers to provide information on their systems, and encourage them to do so.

There has been a lot of discussion over the years of the effects of artificial lighting. Although different types of lighting have varying colour rendering properties, there is no indication that any are psychologically disturbing or pose any health hazard.

We are tracking these issues, and would make information available if we found evidence of an actual health risk. Rather than addressing the problem through an educational program, though, we would forward this information for action by the appropriate regulatory authority to have changes made to the product or to have it removed from the market.

Question: In a recent *Scientific American* special issue on Energy, (September 1990), the Rocky Mountain Institute was quoted as saying that the electricity consumption of the USA could be reduced 50 to 75% at a cost of less than 6¢ per Kwh. This is dramatic. Please comment.

Derek Henriques: In the long term, this is probably achievable. However, a major amount of legislation would be required.

Question: It sounded to me from your talk that you view high electricity use per capita as a 'bad' thing. There could be other reasons for high electricity use per capita than low cost, which in itself is beneficial to society. Do you agree?

Derek Henriques: High per-capita consumption compared with other industrial countries may mean that we're using more resources per person than our competitors. In the long run it will be a bad thing for us.

Question: Are thousands of individual gas heaters in homes more efficient than, say, a single large central district heating plant?

Derek Henriques: Yes, they are. District heating systems have seasonal efficiencies of from 27% to 55%. Individual residential heating systems seldom fall below 50% seasonal efficiency.

Question: Why is B.C. Hydro promoting the use of a non-renewable resource like natural gas for heating water? What's wrong with using renewable hydroelectric power for this application?

Derek Henriques: Natural gas is a finite resource, but it's important to make the most efficient use of all our resources. Since the gas is going to be used, using it in the home for heating is more efficient than using it to generate electricity. There is nothing 'wrong' with using electricity for water heating, but if everyone did, it would be a huge increase in the load on our hydroelectric system. By choosing gas, where available, instead of electricity, customers get cost savings, use a resource efficiently, and 'free up' electricity to serve the growing demand and help us delay building the next dam.

Question: Could you tell us which other utilities and which other countries have adopted marginal-cost pricing? And if we adopt marginal cost pricing, how do we avoid discriminating between existing customers and new customers?

Derek Henriques: There would be no discrimination, since all customers pay on the same basis. Any rate restructuring applies to all our customers.

We know of 17 American electric utilities that have 'true' inverted block rates:

Florida Power & Light Company
Duke Power Company, South Carolina
Potomac Electric Power Company, Washington, DC
Indiana Michigan Power Company
Consumers Power Company, Michigan
Detroit Edison Company
Pacific Power & Light Company, Washington
Washington Water Power Company, Washington/Idaho
Idaho Power Company, Idaho/Oregon
Pacific Gas & Electric Company, California
San Diego Gas & Electric Company
Sierra Pacific Power Company, California
Southern California Edison Company
Central Maine Power Company
Granite State Electric Company, New Hampshire
Pacific Power & Light Company, Oregon
Portland General Electric Company

Question: With the conservation of energy reducing the consumption of electricity in British Columbia, wouldn't the surplus hydroelectric energy be sold in the USA or Alberta, and if so, what have we accomplished with Power Smart?

Derek Henriques: With energy conservation, we save electricity that, over the long term, will meet the growing demand in B.C. and delay building another dam, So, when we reduce our energy use, the energy we would have used becomes available year after year to serve new customers. Matching the supply and the demand is a science in itself, and it is possible that we may save more energy in the short term than is needed for load growth. However, when the water is in the reservoirs it is better to produce electricity and sell it on the short-term interruptible market than to spill the water and lose the opportunity to bring in revenue, which helps to keep the cost of electricity down for all our customers.

Question: What specific changes are in the wind with respect to refrigerator design to reduce energy consumption?

Derek Henriques: Current models of refrigerators are at least 25% more efficient than models even three years old. For 1994, we're going to see another big leap when new efficiency levels are legislated across Canada. In the works now are new insulating materials being tested for use in fridges, compressor modifications and better seals.

Question: In B.C. Hydro's efforts for rate restructuring, how much opposition have you run into from the large industrial users? How can the public offset this counterproductive lobby?

Derek Henriques: We have not seen any opposition to the proposed rate restructuring. The large industrial users have shown interest and a desire to better understand the concept and work with us. The restructuring proposal is quite complex, requiring some effort and 'number-crunching' for the customer to calculate the actual effect on costs. For this reason, the B.C. Utilities Commission has granted a postponement of the hearing until the fall.

Question: What community education programs re: energy efficiency are planned by B.C. Hydro? For example, is B.C. Hydro considering energy retrofit demonstration programs for homes, retrofitted using the best available technologies, and would staff be available to provide unbiased information for citizens? Would there be a similar program for builders?

Derek Henriques: Our education programs have targeted the whole province in one way or another, from schoolchildren, Boy Scouts and Girl Guides, to homeowners, to CEOs in industry. We participate in trade and home shows and sponsor regular radio shows and the Kid Zone program on the Knowledge Network. Every Power Smart program has an education component to it. The Home Improvements program, for example, provides training for auditors, homeowners and contractors, in the areas where it is operating, about energy-efficient home retrofit measures. Builders and contractors receive training and certification through the Quality Plus Home program. Altogether, Power Smart has conducted training sessions for over 3800 professionals, contractors and tradespeople.

Question: B.C. Hydro used to have a program which provided free energy audits for older

homes. I am sure the public would welcome this program back, even for a fee. How about it?

Derek Henriques: The Power Smart Home Improvements program is available for electrically heated homes in some areas of the province, and we plan to expand it province-wide in the future. It offers free audits as well as incentives for homeowners to actually carry out the work. For gas-heated homes it would be up to the gas utility to take on this type of program, as B.C. Hydro no longer provides gas service.

Question: When, if ever, is B.C. Hydro going to get tough? By extra billing for wasteful electricity use after an energy audit?

Derek Henriques: The introduction of any such measure would be entirely dependent on direction from and approval by the B.C. Utilities Commission. As a regulated utility, our mandate is to supply electricity in an efficient and economical manner to all our customers.

Questions Answered by Martin Hocking after the Forum:

Question: In British Columbia we are logging our forests at double the sustainable yield rate: 100 million cubic metres of wood are harvested annually at present. What does the industry propose to do about co-generation, which burns wood wastes, when logging is cut back to a sustainable level, as it surely must be? Maybe the wood waste should be ground up and returned to the forest to fertilize growing trees?

Martin Hocking: The B.C. pulp industry is already recycling much of its wood waste, such as slab and shavings, as raw material for its pulping operations. Other wood waste such as bark, which is not useful for pulping, is already being burned for energy recovery. Finally, the spent liquor recovered from raw pulp after cooking, which contains the dissolved components of the wood, is also used as fuel. To do this, the liquor is concentrated and then the organic material it contains is burned to recover both energy and the spent chemicals. In these ways, plus present co-generation practices, some 50 to 70% of the total thermal energy requirements of current B.C. pulp mill operations is met from wood and related wastes. This percentage could be made higher but the capital expenditure necessary to do this is not justifiable at present current relative prices of wood waste, electricity and fossil fuels. A significant change in the relative costs of these fuels could alter the picture.

Chipped wood waste, with some additional energy expenditure, could be returned to the forest floor. But the mill processing energy requirements presently provided from this source would have to be replaced by some other fuel, which in B.C. would probably be residual fuel oil or natural gas.

Question: What is your past relationship with Dow Chemical?

Martin Hocking: Since 1971, I have been on the faculty of the University of Victoria. Details of my early technical experience with Dow Chemical as well as my more recent experience with companies in the pulp and paper industry, petroleum processing, municipal waste disposal, etc. are summarized in publicly-available reference sources such as American Men and Women of Science, issues of the American Chemical Society Directory of Graduate Research, Chemical Abstracts, etc.

Questions Answered by Lon Mandrake after the Forum:

Question: There seem to be few electronics courses and labs in our high schools. The world is changing rapidly, and perhaps if these courses were available, it would provide another avenue to foster interest in science, rather than the traditional basic science courses. Electronics courses might appear to a student to be more relevant for everyday life.

Lon Mandrake: The traditional basic science courses are prescribed by the provincial curriculum and there is little time for alternate courses such as electronics, except as an Industrial Education course. Unfortunately, with the strong academic push in schools today, the Industrial Education courses are not chosen by as many students as in the past.

Question: I'm sure you will have heard of the SEEDS Foundation (Society, Environment, Energy, Development Studies) which provides teaching materials on energy topics for elementary schools. But I have heard that this material is not as popular in B.C. schools as in other provinces. Do you have an explanation for this?

Lon Mandrake: I have seen the SEEDS ma-

terials and they look very good. Again, as I mentioned before, we science teachers have a rigid core curriculum which must be covered at the Grade 8, 9 and 10 levels, and of course in the Senior courses. The SEEDS material can be used to supplement some of the curriculum, but that, of course, is the choice of the teacher.

Question: I get the impression that industries are somewhat disappointed in the response of teachers to their role as transmitters of messages such as Power Smart. How knowledgeable do you think industry is about educational aims and processes, and do you feel that industries should consult with the educational community in the design of educational programs? Blair Trousdell

Lon Mandrake: I don't believe that industry is aware of the educational system and how much of the science curriculum which is taught is mandatory and how much is discretionary. Some of the industry supplied material I have seen is much too extensive and, in my judgement, is 'off the mark' for the science curriculum. I think it is essential that some consultation take place between science teachers (the B.C. Science Teachers' Association) and industry representatives, if there are going to be materials produced which will help teachers and students and be relevant to the grade level aimed at.

Question:

(1) The focus of education is usually on children. However, the results of these efforts aren't felt for many years. If we want to improve our environmental prognosis for the short to medium term, we need to educate adults. How would you propose to begin educating today's decision-makers?

(2) The objective of many environmental/conservation actions is to 'convince' people that the reason we should do this or that is to 'save the world'. Isn't the real issue to save the human race and shouldn't individual responsibility in the context of our own benefit be the focus of environmental conservation programs? How do we achieve this goal?

Lon Mandrake: If it was up to me to educate adults on the issues of the environment and conservation, I would like to see more relevant articles in magazines, television, newspapers and other media which are readily accessible to those adults. From my experience with our community lecture series involving research scientists, public lectures have met with poor turnouts in the past. College lectures and courses tend to reach only those adults who are already pretty well informed. We must look at ways to reach adults who are not well informed. Maybe the Knowledge Network is one avenue that will help.

I see a major component to any educational scheme is to make what is to be learned relevant to the individual doing the learning. By making people aware that learning about the environment will benefit them and their offspring is an excellent way to make it relevant. Hopefully, they will also learn to care about the environment for others, too.

Again, the best way to reach our adult audiences is through whatever form of media they are used to reading or watching or listening to for reliable information. Programs on television, articles in the newspapers, in popular magazines and over the radio are probably the best way to disseminate educational information.

Questions Answered by Einar Field after the Forum:

Question: Regarding public school education, is B.C. Hydro providing information and educational material to the November 1991 Science Teachers' Conference?

Einar Field: B.C. Hydro education representatives will be attending the November 1991 Science Teachers' Conference. Our educational representatives will be available to answer questions at our Partners in Education Booth, where all our education materials will be displayed. We are also working with conference coordinators to finalize other activities that we could become involved with, such as providing guest speakers and tours of our generating facilities.

Question: Would B.C. Hydro consider contracting directly with the School Boards to use science teachers and motivators to develop user friendly courses to be delivered back to the schools?

Einar Field: Our Partners in Education program is already investigating the feasibility and an appropriate structure for a B.C. Hydro Teacher's Advisory Committee. We have already set up ad hoc teacher advisory committees for specific education projects such as safety videos.

LUNCHEON ADDRESS

"POWER AND POSTERITY"

Power and Posterity

John Allan

Deputy Minister, Ministry of Energy, Mines and Petroleum Resources

Introduction of the Luncheon Program by Einar Field

Ladies and gentlemen, if I could have your attention for a few minutes please. I know that some of you are not quite finished with your dessert, but I think we should start this afternoon's program now. I'll ask Mr. Jack Waldie to come up and introduce the luncheon speaker. Mr. Waldie is a member of Hydro's Board of Directors.

Introduction of Guest Speaker by Jack Waldie

Thank you, Einar. Ladies and gentlemen, good afternoon. Our scheduled guest speaker was to be the late Honourable Jack Davis and at last evening's official opening ceremony, our Chairman, Mr. Bob Wyman, dedicated this Fourth Annual Electrical Energy Forum to his memory.

Although Jack was not one to seek recognition, I know he would have been eminently proud of this action. And I would like to thank Bob Wyman publicly for his recognition of Jack Davis, for the kind of man he was and for his very large contribution to our country and to our province.

I'm very pleased now to introduce our speaker for today's luncheon, Mr. John Allan. John Allan was born and raised in Scotland and moved in 1956 to Manitoba. He obtained his Bachelor of Arts degree, with honours, from the University of Winnipeg, followed by a master's degree in Economics from Queen's University. He then entered the fields of resources and economics in ministries of other provinces and joined the British Columbia Ministry of Energy, Mines and Petroleum Resources in 1981. He has held several senior positions in the Ministry since 1988, and was appointed Deputy Minister in 1990.

I first met John at the World Energy Conference in Montreal, in 1989, and have served with him on the Board of POWEREX for the past year. I've gained considerable respect for him and for his knowledge of the province's resources, plans and policies. Would you please join me in welcoming the Deputy Minister of Energy, Mines and Petroleum Resources, Mr. John Allan.

Power and Posterity

Thank you for that kind introduction, Jack. Good afternoon everybody. On behalf of the Ministry, one of this Forum's sponsors, I'd like to welcome you to the Fourth Annual Electric Energy Forum.

Many of you, of course, will be aware of recent ministerial changes at Energy, Mines and Petroleum Resources. An earlier version of the Forum brochure did indicate, as Jack Waldie pointed out, that the Honourable Jack Davis was to be the speaker today. And most of you, particularly local people, will know how saddened we were by Jack's recent passing. I think one of the last times he was able to travel out of the Vancouver area was to address last year's Energy Forum in Prince George.

On Monday, this week, the Honourable Jack Weisgerber was sworn in as the new Minister of Energy, Mines and Petroleum Resources.

The Minister has asked me to pass along his greetings to you and also his apologies for not being able to speak to you today. The Minister is extremely excited about his new portfolio but unfortunately had to attend a Cabinet meeting which is going on right now in Vancouver. So I hope you'll understand his absence. I'm sure he wouldn't want to miss his first day on the job in

Cabinet. I know I certainly wouldn't.

My topic for this session at the Forum is somewhat challenging, but I think very appropriate. No doubt the title of the talk I'm giving, 'Power and Posterity,' will mean different things to different people and also I think will have different meanings at different points in time.

I think you may agree with me, that power development can be slotted into two time periods in this province, two distinct phases. Each of these phases has implications for posterity and given the long-term nature of power developments, these implications are both long-lasting and overlapping. Furthermore, I think I can safely say that power development has had a lasting positive effect and will continue to do so in this province.

Please allow me to elaborate by first describing where I think we stand today in power development. The provincial government, as many of you will know, has adopted the concept of 'sustainable development' to guide resource development and use. The sustainable development approach is really a way of organizing our thoughts on what we do, and how our actions influence economic, environmental and societal choices now, and in the future. We're increasingly taking account of the long-term intergenerational impact of our decisions; we want to view the choices we make now, in the light of posterity or future generations.

For most renewable resource industries, such as fisheries and forestry, there are parameters, physical as well as economic, which already limit the extent of resource activity. There are not the same obvious and immediate limits to activity in the electric industry.

Our province has an abundant electricity supply, at least potentially. If the demand is there, and we choose to allow it to develop, we have an incredible resource. There are many rivers and streams that can, in some measure, be harnessed. The hydroelectric potential of British Columbia is probably three to four times the capacity that's been developed to date.

We also have other attractive means of generating electricity, such as natural gas, coal and wood waste. We are already producing a small amount of energy from municipal waste. The province's resource potential from these various sources is truly impressive, at least on paper. The numbers add up to a very large potential indeed.

In addition, we have a significant bonus in this province in the form of the Columbia River Downstream Power Benefits which revert to the Province beginning in 1998. This major new resource for the province is free, in both the financial and environmental sense, as the facilities are already in place in the U.S.

Therefore, we're really in the midst of plenty in British Columbia and the cost picture is relatively attractive.

But as I mentioned earlier, we've shifted our emphasis and our priorities in this province, primarily for environmental and resource use reasons familiar to us all. The sustainable development approach encourages us to look at all options and to include all costs, financial, environmental and societal, in any evaluation of these options.

To understand why, I'd like to expand on the point that I made earlier about power development occurring in different time periods.

The development of the electricity potential of this province can be separated, as I said, into two distinct phases. The first phase occurred during the period of the 1950s until the mid 1980s. And I know there was development in the province before the 1950s, particularly in the Trail area, with West Kootenay and Cominco, but by and large, the major developments that we now have today, took place from the 1950s onwards.

This period saw the construction of major hydroelectric and related developments. The Province adopted a Two Rivers policy, based on development of the hydroelectric potential of the Columbia and Peace River systems. The Columbia River Treaty brought about the construction of major dams in British Columbia and a share of associated power generation in the U.S. I'm sure I'm telling many of you information that you know already. Major hydro electric developments by Alcan and Cominco signalled a desire to promote the industrial and economic development of the regions in which these facilities were constructed.

The formation of B.C. Hydro in the early 1960s created a single agency to develop the hydro electric potential of the province in a well-

planned manner. This vision which dominated the first phase was to develop a provincial electricity generation and transmission system as a tool to stimulate the economic growth and expansion of the province.

One might say this was a period marked by concrete and steel and one marked by limited options. Usually the options were, "Which dam do you develop next?"

The early to mid 1980s witnessed a marked change in approach to the development and use of the province's hydro electric potential. The vision which dominates this second phase can be expected to guide developments in the electricity industry and market for at least the next ten to fifteen years.

This is not to say that we developed our power system in the wrong fashion. I think we have much to be proud of with our existing hydro development and relatively attractive power rates. Rather, today's society is asking us to make it even better.

In B.C., I think we got off to an early start on the sustainable development path with the passage of the **Utilities Commission Act** in 1980, the introduction of the Energy Project Review Process and the publication of various documents such as the 'Guidelines for Benefit Cost Analysis' and the 'Mitigation and Compensation Guidelines.'

In doing so, we began, some ten years ago, to alter the attitudes and the investment criteria consumers have traditionally taken in decisions regarding electricity use. This new approach has also involved a significant shift in the way the industry and its employees approach their business and decision-making. Changing attitudes and the adoption of new approaches towards electricity involves education for both producers and consumers.

In the past, the power industry responded to the increasing demand for electricity through adding new major sources of supply. The emphasis of the industry has now shifted to actively manage demand in an effort to delay the need for new capacity. We are also endeavouring to get the most out of existing resources for both economic, rate setting and environmental reasons.

The changes I'm referring to are partially technological in nature but they're also primarily marketplace–related. Government's energy policy has reinforced and, in some cases, initiated these changes in the market and industry.

The traditional view of the electricity industry is that the market can be efficiently served by a natural monopoly. In this province, we have found, at this stage in industry's development, that there is much scope for efficiency gains through competition and private sector participation in the electric industry.

Indeed, B.C. Hydro has initiated a process which has been termed by some as 'breaking down the monopoly,' giving consumers other choices besides buying from B.C. Hydro.

Now I could point to several key initiatives that signal this change in the industry and market.

First is the role of the private sector.
For example, increasing the scope for private sector participation and the generation and transmission of electricity for both domestic and export markets has been a key initiative. This will alter the composition of the industry in the future.

Purchases by B.C. Hydro from private generators and the provision of transmission access for direct sales between buyers and sellers is also stimulating the private sector part of the industry. B.C. Hydro is moving towards making its transmission lines common access carriers.

Self–generation, especially by industrial customers, will also meet a growing share of future energy requirements.

The second key initiative is the power exchange.
The development of a power exchange which was recently announced, will facilitate short term sales between utility and non-utility suppliers and consumers on a market basis. This will also improve the efficiency with which existing facilities are utilized.

The third key initiative is demand side management, the Power Smart program.
The emphasis now and for the foreseeable future is on actively managing demand, through conservation and efficiency initiatives. This represents a major re-orientation of the industry

away from past practices which responded to growing demand by increasing supply capability.

This creates opportunities in the private sector development, manufacturing and installation of energy efficient technologies and methods.

Issues for the Future.

Several important issues will assume a prominent role, I feel, in the future of the electric industry in this province.

1. Sources of Future Supply.

We feel that the private sector will increasingly be relied upon to develop new sources of energy. When these new supply sources are required, the industry will tend to examine project scale more closely for environmental, financial and marketability reasons.

The disposition of the Columbia River Treaty Downstream Benefits within B.C. will involve important choices for the Province. And I should stress that these benefits, as I said, come back to the Province and the right of the people; not to B.C. Hydro.

Environmental considerations will, no doubt, exert an increasing influence on these choices.

Just to elaborate for a moment on the Columbia River Treaty Downstream Benefits, you bring them back; the Province owns them. Clearly, the Province could sell the Benefits to Hydro. The range of options is tremendous and maybe we'll get into the options in the question and answer period later. But we could sell them to Hydro. We could develop industrial activity with them. We can forego the need for new capacity. Quite an added bonus for us.

2. Rates and Conditions of Service.

The level and structure of rates will increasingly be guided by their impact on conservation and efficiency.

This involves the issue of the direct returns to the Province, the so-called 'dividend', that provincial residents, as shareholders of B.C. Hydro, should expect from the electricity industry through water rental fees, dividends and taxes. We have also come to realize that maintaining prices at artificially low levels has led to inefficiencies and waste, and conflicts with sustainable development objectives. On the other hand, rates must be consistent with the consumers' ability to pay. A tough balancing act, I admit.

3. Obligation to Serve.

In view of the changes which have occurred and are expected to occur in the industry, we in the Ministry have begun to examine B.C. Hydro's assumed obligation to provide service.

In this province, we have taken steps so that our policy is allowing us to increasingly confine the essential operations of the monopoly utility, B.C. Hydro, to serving a core market. The core market is comprised, of course, of residential customers and other customers that really have no possibility of negotiating an alternative source of power. The core market will belong solely to a utility and the utility must build in order to serve the core market's needs. In many respects, this is similar to our core market policy for natural gas.

Now, B.C. Hydro has historically built to serve the core market as well as the rest of the market. But Hydro has also served large industry, and some of these companies could develop their own energy sources or buy from private power producers if they had to or were given the opportunity to do so.

In the future, we expect that Hydro will serve the core market and any non-core industry that wants to buy from Hydro. Those industries which are not in the core market will be able to supply their energy needs by buying from Hydro **or** by buying directly from private power producers under negotiated terms and prices, or through self–generation.

Private sector companies can take advantage of a low-cost generation source at a certain location at a price which may be quite different from B.C. Hydro's price. A lower price will, of course, attract industry to the vicinity of a new electrical generating plant.

So, in a nutshell, there can be regional or locational differences in costs and prices through the private sector, but not through B.C. Hydro, which serves the core market at uniform average-cost based rates. A large industry can take advantage of some low-cost regional power development by locating its plant nearby. This is one of the main reasons why the government has encouraged private sector participation in the industry.

The provision of service by B.C. Hydro may become more 'conditional' in the future, requiring the customer to utilize the best energy-efficiency technology.

4. Public Consultation.
We think that increased reliance on public consultation and education, and meaningful public input on key decisions will characterize the future. This includes greater public consultation in the electricity supply planning process.

5. Exports.
The Government of B.C. supports the export of electricity as long as benefits exceed costs, including costs to society and the environment. And this benefit has to exceed costs by a significant margin. We feel there is a role for exports that is consistent with the concept of sustainable development.

The Province's electricity export policy emphasizes private sector development of generation projects to serve the firm export market.

The private sector will be the 'risk taker' in building projects for export. B.C. Hydro will be fully compensated for any services it provides, such as wheeling or shaping or stand-by.

Now as most of you know, the export of electricity from the province requires Provincial approval. To be approved for export, electricity must be surplus to domestic requirements, and be in the public interest.

All power projects which may be developed to serve the long-term firm export market, will be scrutinized through the Provincial Energy Project Review Process, to ensure that these projects are economically viable and environmentally sound. Public hearings will be held concerning such projects.

To date, all power exports from B.C. have been on an interruptible, or short-term firm basis. The potential long-term firm export contracts could be for 15 to 30 years. The output from the private power developments behind these contracts could be repatriated for domestic use, once the export contracts have expired.

B.C. Hydro itself will not sell long-term firm electricity to the United States but will continue to maximize system efficiency through short term electricity exchanges and co-ordination of operations with utilities in Canada and the United States.

Conclusions
I'd like to make just three or four points.

Electricity will continue to stimulate economic growth in the province. This will ultimately necessitate the development of additional sources of supply. However, the current priority of the Province and of Hydro is to improve efficiency in both electricity generation and consumption to ensure the optimal use of existing capacity.

The challenge of the '90s and beyond is to continue transforming the province's power potential into a sustainable level of economic development while maintaining a high level of environmental integrity.

The Government of B.C. is committed to encouraging the sustainable development of electricity resources. To achieve this end, more reliance will be placed on the efficiency of the market, within the framework of well defined, regulatory requirements and environmental standards.

Given the above policy framework, I'm sure that power will continue to have a positive influence on future generations of British Columbians.

Thank you very much.

Einar Field: Mr. Allan has indicated that he's prepared to answer some questions. If you have one, would you please come up to the microphone by the podium so that we can all hear the question.

Question: John, I've got a leading question. The Globe and Mail has headlined the news that Hydro Quebec is selling cut-rate power to new industrial customers. And what I'm wondering, John, is what steps is the Ministry taking with respect to B.C. Hydro that would assure us that we would at least have open knowledge in British Columbia about such transactions versus what seems to be closed knowledge in Quebec?

It isn't that the decision was wrong or that the choice of what to do was wrong, but I think a lot of us would feel very strongly that we should have information about what is being done in

B. C. out there in the public domain. And this is with respect to your statement that we perhaps should use our energy-pricing structure to encourage and stimulate economic growth for the province.

John Allan: Okay. I believe the article was referring to Hydro Quebec and my comments were more directed at private transactions. But let me deal with B.C. Hydro for just one minute.

Any energy supply transaction involving B.C. Hydro and another party would be filed with the B.C. Utilities Commission. All energy supply contracts are required to be filed under the **Utilities Commission Act** before the Commission, for regulatory approval.

We have, in the past, in this province, particularly in the mid '80s, temporarily sold power at below normal tariff rates. We did this because we had surplus power on our hands, mostly as a result of the Revelstoke dam coming on stream ahead of time and the corresponding recession that hit the province at the same time.

So we did use surplus power at discount rates within this province to encourage economic recovery. All of those contracts were with B.C. Hydro. They were all approved by the Cabinet, and made public via Cabinet Orders–in–Council. And I believe the contracts were attached to the Cabinet Orders and we did tell the public who got the power discount, for how long and at what rate, subject, of course, to not disclosing proprietary information about the specific company, for commercial confidentiality reasons.

More recently, we have had two examples of such power discounts. One was written up widely in the press. That was to do with the proposed Wooding Ferrochromium project on Vancouver Island, where the hearing panel that reviewed the project commented on the fact that the Province had offered that company a power discount. That power notionally came from the shorter term surpluses that exist from time to time in the system and was made available under an amended **Surplus Power Act**, if I may call it that, where we recognized the shrinking amount of surplus we had and we limited surplus power sales at discounted prices only to industries that were unique in the province. There was only one ferrochromium plant on the books; an industry that could produce a product that would substitute for imports. The Wooding Ferrochromium discount, of course, was never delivered because the plant was never built.

There's another discount power sale to the second Louisiana Pacific pulp mill in the northeast. The basis of the decision was that, although it was a pulp mill and we do have lots of pulp mills, it was unique venture because it was the only pulp mill to use hardwoods. That was announced about two weeks ago.

In terms of the future, for private sector exchanges, say, between a private power producer building a new facility and a resource industry locating next to the project, I would think that any such project would involve a public hearing on the economic and environmental aspects of the project. I think the contract between the parties would have to backstop the building of the project. And that a public hearing would be held through the B.C. Utilities Commission Act, and I think, Geoff, I could assure you that all such terms and conditions of that kind of development would be made public in the province. The same would go for exports as well. We are committed to public hearings on exports and if we did ever build a project for export in the province, I think the export contract would have to be on the table so that the public could be satisfied that the returns were there well over and above the costs.

No more questions? Very well then, thank you very much. It was a pleasure speaking to you. I know many of you here and for anyone here who knows me and I haven't had a chance to shake your hand or say hello, I apologize.

Again, welcome to Victoria. We put on this weather especially for the out–of–town visitors and we hope that you all enjoy this wonderful facility that we have here. Thank you again.

Thanks to John Allan by Einar Field: Thank you, Mr. Allan. It may have been a challenging topic but you certainly covered a great deal of territory.

Your review of the impact of power developments in the past, and today's government support of the sustainable development, will give us guidance for the future.

Regarding the Columbia Treaty, I think about people like Jack Davis, who had the vision to

develop it in the first place; today's shifts in direction, and the new approach to meeting electricity demand, and finally, the vision of the future.

We'd like to thank you very much for your thought provoking speech. Thank you again, John.

Ladies and Gentlemen, that concludes our luncheon program.

UTILITY EDUCATION INTERESTS AND GOVERNMENT POLICY DIRECTION

EMF Danger: Fact or Fiction?

Leonard Sagan

Program Manager, Radiation Studies
Electric Power Research Institute
Palo Alto, California

Introduction of Leonard Sagan by Einar Field

I think it would be difficult to find a topic that has such an interest level and is surrounded by so much controversy as our next one. Here to speak on 'EMF Danger: Fact or Fiction', is Dr. Leonard Sagan.

Dr. Sagan is Program Manager, Radiation Studies, at the Electric Power Research Institute in Palo Alto, California. Dr. Sagan received his doctorate in medicine from the University of Chicago Medical School and a master's degree in public health from the Harvard School of Public Health. He is the author of many technical papers and books on risk analysis, radiation and other environmental impacts of development.

Dr. Sagan teaches in the human biology program at Stanford University and is a member of advisory committees to the Oakridge Associated Universities, and the TMI Health Studies Advisory Committee to the Pennsylvania State Health Department.

Ladies and gentlemen, please join me in welcoming Dr. Leonard Sagan.

EMF Danger: Fact or Fiction?

Thanks very much, Mr. Field, and good afternoon, ladies and gentlemen.

Let me begin by admitting that I do not have an immediate answer to the question posed by my title, 'EMF Danger: Fact or Fiction?' For a variety of reasons, the scientific issues that need to be understood before we can answer that question are very complex and difficult to communicate in a short period of time, but I shall try to summarize our knowledge of the issue.

In spite of that uncertainty, there is already evidence of rapidly increasing anxiety about EMF exposures, and I should like to begin with some speculation about exaggerated public responses to suggestions of possible health effects.

First of all, **some concern regarding possible threats of cancer are justified**. Some of the media 'scares', like asbestos and cigarette smoking are real. That is, some environmental exposures, particularly when at high concentration and for prolonged periods of time, do indeed cause cancer.

Secondly, **science education in the United States is inadequate** in providing people with the skills necessary to make judgments about the relationship between exposure to certain agents such as EMF and radiation, coffee, or dietary fat and disease. Numerous reports show, at least in the United States, that scientific comprehension among high school students trails that of students in most other advanced nations. What I'm suggesting here is that the ability to assess threats to public health is particularly poor here and this may explain some of the reasons that cancer scares are more common here than in other advanced countries.

Still another reason for over-reaction to reports of agents which might cause cancer is **the nature of the disease itself**. Cancer is a particularly dreaded disease, so that any suggestion that some behaviour or exposure could lead to cancer is understandably frightening and creates a sense of dread and anxiety among the public, and to the

demand that something be done, regardless of cost and the uncertainty of the evidence. In fact, it almost seems as though greater uncertainty leads to greater, rather than less, anxiety.

Sensationalist reporting also contributes to heightened public anxiety about cancer. I do not want to engage in too much media-bashing because in fact I think that the print media have done a good job of reporting on this issue, magnetic fields and cancer. I would not give equally high marks to television, which admittedly does have problems in presenting an issue as complex as EMF in a very short time span, and the need for vivid visual images.

Scientists also deserve some criticism. While they do have an obligation to communicate with and educate the public, they are frequently reluctant to do so. In the absence of good information from scientists, a vacuum is created which is often filled by journalists and others who have some interest in sensationalizing an issue.

Lastly, **regulatory assumptions contribute to the problem**. For example, in the absence of scientific knowledge about the biomedical effects of low dose exposure, regulators have often made the unproven assumption that even the smallest amount of exposure, whether it's radiation or coffee or whatever, is harmful. That is an assumption, it's not science, but the public often assumes that this assumption is scientifically-based; the conclusion that even transient exposures to trace concentrations may cause cancer adds further fuel to cancer hysteria.

For all of these reasons, then, many members or the public do have difficulty in differentiating fact from fiction.

What to do? I would offer three rules to apply when reports of a new cancer causing agent come to your attention.

First, **ask yourself: is the epidemiological evidence sound**? 'Sound' means a number of things. Has the study been repeated in a number of populations by a number of investigators so that we can discriminate between associations and causation? That is often very difficult to do. Many things occur together by coincidence, i.e., without one actually causing the other. For example, one of the century's great statisticians, R.A. Fisher, believed until quite recently that it was equally plausible, from the existing evidence, to assert that cancer caused smoking. His point is that when two things are associated, one has to be very cautious about determining which causes which. When two things, such as A and B, are associated, it is often difficult to be certain whether A causes B, B causes A, or something else causes both A and B. Most of us, with our conventional schooling, aren't given the skills to make that distinction.

Secondly, **are there confirmatory laboratory findings**? What happens to animals that are exposed to this agent? Laboratory evidence, including animal studies is often very helpful: unlike humans, where it's difficult to quantify exposures, and where exposures to animals in laboratories can be controlled with great precision. Animal studies do have other problems, namely that very often the exposures are unrealistically high, i.e., hundreds or even thousands of times greater than human beings experience in their daily lives.

The second problem with laboratory evidence is in extrapolating from rodents to man. We are not rats. We respond differently to chemical or physical agents than they do. Nevertheless, laboratory evidence, including both animal research and observations on cells and tissues are important in providing insights about biological mechanisms.

The third question, **is there a plausible mechanism**? Do we understand how 'A' causes 'B'? If we do, that strengthens the evidence.

Magnetic Fields and Cancer

So now, finally, let us go on to magnetic fields. The evidence relating magnetic fields to cancer comes largely from epidemiological studies. The first such study was conducted in 1979 by Dr. Nancy Wertheimer and Mr. Ed Leeper. They set about to test the hypothesis that exposure to power frequency (50 or 60 Hz) magnetic fields increased the risk of cancer in childhood. In order for them to do this, it was necessary for them to develop some means of assessing exposure. That is what epidemiology is, it's a science in which the health of people who have received a certain exposure is compared with the health of people who do not have that exposure.

One has to know who is exposed and who is not exposed. So they did what's called a case-

control study. They identified a group of children who had died of cancer in Denver, and they compared the exposure of those children to magnetic fields in the home, with exposures of magnetic fields to a similar group of healthy children.

This is the way they did it. They assumed that the major source of exposure was the neighbouring power lines and then, if one could estimate the amount of current being carried in those power lines, one could use that information to estimate the intensity of magnetic fields in the home. To do that they developed a code, or methodology, that allowed them to look at the lines, eyeballing the lines and making judgments about whether those lines carried high currents, moderate or low currents. Transmission lines were assumed to carry the highest currents and the so-called end pole of a distribution transmission line as having the lowest currents.

Then, together with that judgment, they measured the distance of each house to the lines. Those two measurements together allowed them to judge whether exposures to the child was high, medium or low; actually four 'wire code' categories were determined. What they found in that study was that there did appear to be an association. That is to say, children who were in high exposure homes, as indicated by this methodology, did appear to have increased risk of contracting cancer.

Now, there have been a number of such studies of childhood cancer. A second study was done by Dr. David Savitz, who in addition to using this wire coding system also went into the house with a dosimeter, and measured the intensity of the magnetic fields. Interestingly enough, what he found was that again there did appear to be an association between using the wire code as an indicator of magnetic fields and the risk of contracting childhood cancer. But the actual measured fields inside the homes showed almost no relationship. So what did that mean?

It could have meant a number of things. It could have meant that the wire codes were actually a better indicator of indoor magnetic fields than the measured fields, because after all, magnetic fields in a home vary throughout the house, vary throughout the day, probably throughout the year and possibly change over the years. So one view was that it was indeed the magnetic fields, as indicated by the wire codes, which explained the association of those codes with cancer.

Another view was, and still is, that magnetic fields had nothing to do with the association between wire codes and cancer, and that this was a chance association, or that it resulted from some other factor, such as, for example, automobile emissions, air pollution, pesticides or cigarette smoking. We really know very little about the causes of childhood cancer. So that is where the situation was until just a few months ago, when we had the results of a third study, a study at the University of Southern California that was sponsored by the Electric Power Research Institute.

What was hoped was that this study would resolve the questions 'Are wire codes associated with childhood cancer?' and 'Would better measurements of magnetic fields over a long period of time, rather than just an instantaneous measurement, show a better correlation with wire codes than between measured magnetic fields and the risk of cancer?'

The answer, not yet published, and still preliminary, is identical to what Dr. Savits had found in Denver; namely, an association between wire codes and childhood cancer, indicating a risk of about two. That is to say, children in the highest exposure homes as indicated by wire codes apparently had a risk of leukemia two times greater than children in low exposure homes.

But when the magnetic fields in the houses were measured, and this time using very sophisticated technology, measuring not at one instant, but over 24 to 72 hours at 15 second intervals, both inside and outside the houses, there was no statistically significant correlation.

So there we are. The explanations of these findings are either that there is something about magnetic fields that we are not capturing in these measurements, something like transients or 'interruptedness,' as some people call it, or else there is an association between wire codes and cancer that has nothing to do with magnetic fields at all. And that is entirely possible.

The other thing that was found in the USC study that is intriguing was a relationship between the use of appliances and the risk of cancer, the magnitude being even greater than that of the

magnitude of the risk associated with wire codes. What they did was to question families about the child's use of 13 different appliances. In nine cases, the children with leukemia had used the appliance more often than the healthy children, and in two cases, electric hair dryers and black and white TV sets, the difference was statistically significant.

This could be chance or it could be bias. Parents of children with cancer are much more likely to remember behaviour that might be related to cancer than are the parents of healthy children. Still, it's an intriguing observation and deserves to be followed up.

There's one more thing I have to say about epidemiology. I do not have time to discuss a large body of occupational studies where people in so-called electrical occupations, like electricians and almost any trade that has the word electrical in it, including electrical engineers and electronics technicians. People in these trades have been studied to see whether there's an excess of two particular kinds of cancer, leukemia and brain cancer.

In many of these studies, there is a small excess, about a 20 percent increase in the incidence of leukemia and an even higher increase in the incidence of brain cancers. The problem with this group of studies is that the magnetic fields have not been measured, and so it cannot be certain at all that this small excess is the result of magnetic fields or welding fumes or other so-called confounding factors.

Now for laboratory evidence. Animal studies are terribly important. A common question that I am asked is "What happens to rats when you expose them to magnetic fields?" The unfortunate answer is that such studies have not yet been done. Why not? This is a relatively new area of research, and it takes in the order of five years to do the planning for such a study, to do the pilot work, to install an exposure facility, to carry out the life-long exposures of the animals and to carry out the analysis and to publish the results. It just takes a long time.

There are four such chronic animal studies under way in the world today: one, sponsored by the Electric Power Research Institute at UCLA; one that the National Institutes of Health are about to initiate; one right here in Canada, in Quebec, co-sponsored by B. C. Hydro; and one in Sweden.

What about **cellular studies**, observations of cells exposed to magnetic fields? There's been a good deal of that kind of work. The problem is that while studies on cells are useful in trying to understand the biology, it is very difficult to reach judgements on human health by extrapolating from effects in individual cells. As you move farther and farther away from the human organism to rats and finally to individual cells, the significance with respect to human health becomes more and more tenuous. But changes in cells have been found in the laboratory. Dr. Reba Goodman at Columbia University has found that strong magnetic fields appear to change gene expression in such cells.

I should also add that there have also been a number of studies examining whether or not magnetic fields are mutagenic. Do they, like other carcinogens, produce changes in the genes, mutations, or other gene damage? The answer seems to be no, they do not. So, if magnetic fields do somehow contribute to cancer, it is probably through some unusual mechanism. What is being explored in laboratories is the possibility that exposure to magnetic fields may enhance or promote the growth of cells or tumours that have already been initiated by exposures to other carcinogenic agents. The four animal experiments mentioned above are all being done with animals first exposed to known carcinogenic agents and then, on top of that, magnetic fields are introduced to see if such exposures change the frequency or behaviour of those tumours.

Finally, **what about mechanisms**; how could electric and or magnetic fields cause tumours, if that turns out to be the case? In the case of magnetic fields there is simply no consensus about how these very weak fields could influence cells and tissues. You have to remember that our bodies are basically electrical machines, and very 'noisy' machines electrically.

That is what an electrocardiogram is, a reflection of the heart's electrical activity, and so is an electroencephalogram, and an electromyogram; so there is a lot of electrical activity going on in and around cells.

The question that physicists ask is, how could this very weak signal which produces or induces

currents, at least an order of magnitude less than those that already exist within the cells, how could this additional small increment produce changes in those cells? Some physicists, like Dr. Robert Adair at Yale, say that it is impossible, period. He won't talk about it any more.

But on the other hand, these observations in cells that I mentioned a minute ago, tell some people that something is going on, no matter whether the physicists can explain it or not.

So that is where we are today. That is my 20 minute capsule summary for you. My closing remark is that, in my own opinion, this issue is still very much in the formative stages and it is far too early to make judgments about whether the risk is real or not and certainly too early to make judgments about what should be done should there be a risk.

So, Mr. Field, if there is time, I'd be happy to answer questions.

Einar Field: I have a number of questions for you, as a matter of fact. The first one is, in your opinion, do you think utilities would be better off educating and informing the general public about what they know to date about the health effects of EMF, even if this means that they're admitting they do not know all the answers yet, or will utilities be better off avoiding the issue so as not to cause even more alarm and concern.

Leonard Sagan: Is this supposed to be a trick question?

Einar Field: Perhaps.

Leonard Sagan: Well, I think the answer is obvious. Well, maybe it's not obvious to everybody. Different utilities take a different view on this but I'm pleased to say that, at least in the United States, where I have most information, the majority of utilities have taken the view that everybody is better off if the public is informed. As further evidence of this philosophy, Mr. Field, I would point out that the utilities who are members of the Electric Power Research Institute have supported the largest research program in the world to investigate this issue. I think this is in the interest of the public and the utility industry.

Some people say, "Do you not have a self-interest, you and the utility industry, aren't you like the Tobacco Institute, do you not have to protect your own interests and to stonewall this issue?"

I think the answer is an absolute 'No.' Nobody is going to give up the use of electricity, no matter what the research shows, it's just too important. What the utilities cannot stand, what managers of any kind cannot tolerate, is uncertainty about the issue, so it is in both the public interest and the utility interest to try to resolve this issue together with an informed public.

Question: In light of the findings of EPRI/USC study, what appears to be next step in the EMF investigations?

Leonard Sagan: Well, number one, we have to resolve this question of dose. By dose, I mean what it is that might be biologically important in magnetic field exposure. There may be some characteristic of exposures, such as short-term transients, that are biologically more significant than the average exposures over time, and to better understand this, we desperately need some laboratory model (that doesn't now exist) that can be established in many laboratories so that this question can be asked: do these cells or small animals respond differently to spiky exposures than to chronic low-dose exposures? That is question number one.

The second important question to be resolved is the matter of wire codes and the association now found in three studies between wire codes and childhood cancer. I think there is a high degree of urgency now in trying to get to the bottom of that. That is the second question.

The third question I think we have to know more about is what I call the 'magnetic climate', who in our society is exposed? We know little about who is exposed to large magnetic fields and who is not.

Question: You mentioned the length of time that it has taken to correlate lung cancer with smoking. At what point would you feel concerned about the cancer/EMF relationships?

Leonard Sagan: Let us assume a linear progression from perfect ignorance to perfect knowledge. An example of perfect ignorance might be the level of knowledge which existed in 1900 regarding cigarette smoking and disease, whereas

an example of perfect knowledge might be our current understanding of the relationship between cigarettes and lung cancer.

Given that crude analogy, I would say that in our understanding of EMF and cancer that we are at no more than about 1910 or 1920; or, to put it on a scale from 1 to 10, I think we're now at about a 2 or a 3 in our understanding. I think my title was an appropriate one, 'fact or fiction?' I do not think we know yet.

Question: There are similarities between cell structures in plants and animals/humans. Is there any evidence that the cells of plants under the transmission lines are in any way affected?

Leonard Sagan: We've done work on that, at Penn State, exposing a variety of crops to electric fields. One sometimes sees burning at the tips of particularly needle-like crops, like grasses, but in those experiments there was no evidence of a decrease in fertility, that is, yield of that crop.

Question: Have cellular studies been carried out that would indicate any enzymatic changes within cell groupings as affecting nutrition in complex organisms?

Leonard Sagan: Well, I referred to changes in cells that have been observed in a laboratory. There have been observations of changes in calcium metabolism at the cell surface. Some of those studies report an increase in flux from the cell membrane and in some cases it's an absorption of calcium to the cell membrane. There have been studies of gene expression, I referred to those.

There have been a number of such observations. The problem with these is that there's no single observation that's been so well replicated in any laboratory that there is universal agreement that this effect is real and can be replicated at will. My own feeling is that there is something going on here. Where it occurs, whether at the cell membrane or within the cell, is not at all clear.

The leading theory is that if there is an interaction, it occurs at the cell membrane. There is also some more intriguing evidence about melatonin, a hormone that is secreted by the pineal gland, which is a tiny gland at the base of the brain. In all of us, this hormone level cycles throughout the day. Its maximum concentration occurs at night, and it falls during the day. It is controlled by exposure to light.

This hormone is thought to be responsible for some immune functions and some reproductive functions. What is intriguing is that in some laboratory experiments, exposure to either electric or magnetic fields, but not both together, has been shown, but not shown conclusively in my opinion, to suppress melatonin. It's an intriguing lead that needs more investigation.

Question: Would you buy a house next to a high-voltage transmission line?

Leonard Sagan: It's not my job to make recommendations to people, but I have asked myself that question. The way I ask myself the question is, supposing one of my children, and I have three, and three grandchildren; supposing one of my children should ask me that question. What I would say to that child is that if it's a nice house, with a good price and it has other attractive features about it, I'd tell them to ignore the magnetic fields, and buy it.

Thanks by Einar Field: We'd like to thank you very much for your address, Dr. Sagan. And thank you of the update on the recent EPRI studies, which still confirm that it's a very complicated issue.

What surprised me was your reference to the difficulty of getting people to participate in some of the EMF studies, in terms of the phone survey and so forth.

Leonard Sagan: I think it's not a question of magnetic fields, it's more a question of a stranger calling and asking to come to your house and you don't know who he is. The tendency, for most people, is to say 'no'. In some cases, it was a business phone, in some cases there wasn't a family living there, so there were many plausible reasons for the low acceptance statistics.

Einar Field: Thank you again, Dr. Sagan.

Electric Vehicle Advantages

Henry M. Morgan

South Coast Air Quality Management District Board
Los Angeles, California

Introduction of Henry Morgan by Einar Field

A development which has been in existence for many years, but perhaps has not gained the momentum expected from an environmentally–concerned public, is the use of electric vehicles. Our next speaker will provide us with up–to–date information on this topic. He is Councilman Henry Morgan. He represents the eastern region of Los Angeles County on the South Coast Air Quality Management District Board.

Mr. Morgan received his Bachelor of Arts degree in physics from Pomona College. Councilman Morgan was a senior marketing representative for the IBM Corporation, specializing in banking, insurance and manufacturing until his retirement in 1987. He was first elected to the Covina City Council in 1978, serving as Mayor from 1982–1983, and as Mayor pro tem from 1980–1981 and again in 1984–1988. Councilman Morgan was a board member of the Foothill Transit Authority and a member of the California Regional Water Quality Control Board. He's active in many service organizations. Please welcome Mr. Henry Morgan.

Electric Vehicle Advantages

Thank you, Einar.

From my introduction, you'll know I've been involved in a lot of municipal government work since I retired. But when you're retired, what else can you do? You've got to do something of that nature. Anyway, I'm just delighted to be here in beautiful British Columbia, to talk about electric vehicles. Normally, politicians would rather talk about themselves, but today I'm happy to talk about electric vehicles in Los Angeles.

As Einar said in my introduction, I'm a student of physics, so technical aspects of urban planning, transportation and management have been very interesting to me. I think it's nice to say that we're finally on the road to the electric vehicle, but when I looked out at the Plaza outside today, it seems that everybody here already owns one! I'm afraid my talk is going to be a bit like preaching to the choir.

I mean, everybody here is pretty well convinced that the electric vehicle may be the answer to our clean air problem in Los Angeles. Now, I do have a problem with coming to Victoria. How can you possibly breathe air you can't see?

I'd like to begin by thanking B.C. Hydro and our Canadian friends for hosting this important symposium and fostering the advancement of electric vehicle technologies.

It's clear that the automobile industry has taken the development of a successful electric vehicle as a challenge, and in spite of what initially looked like reluctance on the part of industry to step forward in this area, the General Motors of the world and the Edison Electric people, have all become outwardly interested in the environment, and, in the case of General Motors, in cleaner automobiles. General Motors has announced publicly that they will be in the electric vehicle market and they will make money and they will be first. I'd like to know where GM's Impact car is today. They must be keeping it under cover somewhere.

I want to talk about the problem we have in southern California. As you know the automobile is the chief culprit when it comes to clean air. Los Angeles probably has the dirtiest air in the

United States. I understand that the Fraser Valley up here has terrain something like the Los Angeles area, with an urban area ringed by mountains and prevailing winds off the sea in summer. In your case, the winds change and blow it away after a while. In our case, the wind keeps the smog trapped.

Los Angeles has decided that we've got to somehow expedite transportation technologies that don't rely on petroleum fuels and internal-combustion engines. Advancements in batteries are absolutely essential. It's interesting to note that 1912 Detroit electric car out there used an Edison cell, which is a nickel/iron battery, but we're still using the familiar lead/acid batteries in all the other electric cars at this Forum.

But look at Los Angeles and why we think this is a magnificent challenge; its better to say big challenge than to say a big problem. The statistics are unambiguous and compelling. Now we have 13 million people living in the Los Angeles area, they drive nine million motor vehicles, and cover 240 million miles total distance daily, on average. For decades, Southern Californians have endured America's worst-quality air and the damage associated with that includes crops and health effects and damage to buildings. In fact, it's been computed that the price of the Basin's air pollution in human health costs alone is nearly $10 billion a year, so it's very important to us.

More recently, a study at UCLA indicated that the children living in the Los Angeles air basin have suffered a 15 percent reduction in lung function by the time they reach the age of 12, so it's very important to us to find an alternative to having everybody driving their own automobile. As an aside, one of the side assignments I have is that I work in congestion management. To fix congestion in an area, you build more roads.

The problem we have with air emissions is if you build more roads people will use them, so that's kind of a competing goal, because how do you relieve congestion and at the same time reduce air emissions? We're talking about things like completing freeway gaps. That probably makes a lot of sense because if they're not completed you can't reduce congestion. Then the next thing you do is to build a lot of rail transportation, to try to get more people off the roads.

Then you might charge $2.50 or $4.00 for a gallon of gasoline. That would really motivate people in an economic fashion. The innovative side of that, I would spend $1.50 of that to buy everybody insurance. I don't know if you have problems here in British Columbia with uninsured motorists, but we certainly do. I think virtually half of our motorists aren't insured and that means that traffic accident costs create a tremendous problem for us.

I think the last thing I would probably do is maybe institute some kind of birth control or immigration control so there wouldn't be quite so many people coming to Southern California. Our **Clean Air Act** in California in 1988 provided legislative power to do some of these things. It called for a 55 percent reduction in reactive hydrocarbon emissions from motor vehicles by the year 2000. It also aggressively targeted the reduction of other critical pollutants and air toxins from all significant sources.

This had to happen. This is a fallout of our federal **Clean Air Act** that said, you will, by the year 2010, have taken the identified pollutants down to the compliance level. They passed that along to the state. They wrote the **California Clean Air Act** and they passed it down to special districts to figure out how to achieve compliance. The South Coast Air Quality Management District covers the whole of the Greater Los Angeles air basin; county boundaries don't mean much, the District has to cover wherever the air goes.

They gave us a challenge. They told us to come up with a set of rules, that will clean up our air by 2010. That was a big challenge. With regulating agencies the two most important things are:

1: give the agency the ability to fund itself, don't ask it to look for funds from somewhere else, and

2: give them the authority to make these things happen.

You'll see agencies that don't have that authority, and don't have the ability to raise money. In the toxic waste area, legislation about refuse reduction says: 'Cities, will reduce the waste stream to your landfills by 25 per cent'. Then people ask, 'How can you make cities do that?' You could try $10,000 a day fines, as an example.

But it's not that anybody has done this yet, but these are the things they may have to do; they

will have to give these agencies financial hammers in order to get action to clean the air, cut down on refuse, or take care of the environment.

Now, to meet the Clean Air Act in the Los Angeles basin, we've got to get away from the internal combustion engine automobile and get on to something that runs on hydrogen, something with no carbon emissions, like fuel cells.

A recent study conducted by the University of California concluded that the use of electric vehicles 'will dramatically and unequivocally' reduce carbon monoxide and hydrocarbon emissions and likely decrease nitrogen oxide emissions. Equally important, emission of air toxins such as benzene could be virtually eliminated.

We were having enough trouble wrestling with the Clean Air Act, and then they threw 'global warming' at us, and suddenly even CO_2 emissions were no good either. Maybe Geoff Ballard's fuel cells will take care of this.

How do we handle this in Los Angeles? I noticed, on the original program, that Mr. Marvin Braude was invited to speak. Mr. Braude invented a thing called the **Los Angeles Initiative**. That's an effort to put 10,000 hybrid electric vehicles on the road in southern California by 1995. I don't think it will happen quite that fast. But as Marvin Braude said, "We must, as city officials, take leadership and say, we will commit to electric vehicles to cut pollution in Los Angeles." He says unless we do it, nobody else will.

So they committed major funds from the City of Los Angeles to have vehicles developed. They tried G–vans and J–vans, with lead–acid storage batteries, but they wouldn't really do what they had to do. They wouldn't go far enough and they wouldn't go fast enough.

We think that creating a market for 10,000 electric vehicles was a positive step for forcing advances in the technology. It did begin to build a market. They do blame market inertia, perpetuated by the economic and political power of petroleum and automotive industries, which continue to favour higher-emitting, low-efficiency conventional motor vehicles. If it doesn't burn oil it can't be good. In the automobile industry, if you can't make a dollar on it right away, they aren't much interested in building it.

So they're continually pushing the less-efficient conventional engines, but in their defence I think the petroleum people are going to develop better fuels that will really go a long way toward clean air. Unfortunately with the global warming and so on I don't know how they're going to eliminate the CO_2 from those engines. In their defence, they're really going to try to deliver reformulations of gasoline fuels that will give us much cleaner automobiles.

But we think that it's fine to push them in this direction because the citizens of southern California deserve cleaner air. In 1990, our California Air Resources Board (CARB) set tighter emission standards for automobiles. The board I'm on takes care of fixed sources like oil refineries and power plants. The automobile itself, the mobile source, is the jurisdiction of the California Air Resources Board.

So they've set some very tough standards on automobiles. As you know, there's now a 'California car' and then there are other cars. Now other parts of the world are coming into compliance with our Air Quality Standards. The other thing that CARB addressed were the key interrelated problems of urban smog, declining oil reserves, and the changing global environment.

The California Energy Commission works closely with the CARB to integrate all these approaches for motor vehicles into an innovative plan that phases in fleet-averaged standards for new motor vehicles sold in California beginning in 1994. It is a revolutionary concept because, for the first time, motor vehicles and their fuels are treated as single, integrated systems. The result will be the simultaneous development of advanced vehicle technologies and cleaner burning fuels.

It's one way to solve the problem. You don't adapt one or the other; you look at the two things together. The motor vehicle and its fuels are a single problem we're trying to solve. The regulations go beyond the internal-combustion engine and also mandate the introduction of 'zero-emission vehicles' (ZEV).

They're vehicles that do not directly emit any regulated pollutants. Some people say you just can't do that, the technology isn't there: it's impossible. But the fact that the State has mandated technology that some people claim will not be

feasible for many more years is testimony to California's air pollution problems, and our will to solve them. It also reflects a stark realization that our quality of life and ability to preserve our mobility in the urban environment depends on how fast we are able to move into the era of combustion-free, ultra-low-polluting transportation.

The transition to ZEV technology has already started, with a strong push for progressively cleaner fuels and engine technologies. Over the next five years, we expect to see the commercialization of dedicated, optimized alternative-fuel vehicles. Manufacturers are also likely to meet CARB's tightening emission standards by producing and selling hybrid EVs with small range-extending internal combustion engines to recharge battery packs, and to provide for heating and air-conditioning requirements.

I think the resolve of the District and the State will force the introduction of zero-emitting vehicles because, although you cannot eliminate pollution completely, but if you take every possible vehicle group and reduce their emissions as far as is technically possible, it turns out there will be a lot of latitude for the trucks, buses and other types of vehicles that emit a lot more.

The hybrids will be a big part of this thing, the car that will run in the inner city ring with an electric motor and then as soon as it gets out of the ring onto the freeway, you fire up the small gas engines. Our problem on the freeways is the traffic is supposed to run at 80 miles an hour, and I don't know yet how you can do that with an electric vehicle.

However, the Japanese said they have an experimental EV model, not a hybrid, that can go 100 miles an hour and cover 310 miles before needing a recharge. That's the magic combination we're looking for. Like someone told me this morning, "If we don't get around to it the foreign manufacturers probably will and that will push Detroit if nothing else does."

Anyway, by 1998, we'll really begin to see electric vehicles on the roads in California and there will be a mandatory 2 percent proportion of zero-emission vehicles by then. And within another five years, they plan to kick it up to about 10 percent, so we will have 200,000 zero-emitting electric vehicles in operation in California.

So we are providing a pretty strong reason for manufacturers to develop and build these electric automobiles. I don't have any idea of what sort of batteries these EVs are going to have. The North American Advanced Battery Systems Consortium, that's Chrysler, General Motors, Ford, Department of Energy, Electric Power Research Institute and Southern California Edison, which is a big power producer down our way, are cooperatively working on battery technology for these kinds of applications; and they have a budget of about one hundred million dollars a year to spend.

With that scale of effort, it's very likely that they will create some kind of a new power supply that will fit into a suitcase. You look at those banks of batteries in electric cars. In a few years we'll look at pictures of those heavy lead-acid batteries and we'll say "Isn't that funny, because now it's this big." But today, I'd have to say that I don't know how they'll do it.

Our Air District has taken a dual approach to solving our air pollution mandate, with regulatory initiatives and private sector incentives. And the Air Resources Board is pushing very hard. It's the check and balance on us. We, as a local air board, are checked by both the Environmental Protection Agency and the California Air Board, so we've got to comply with all their rules. Most of the time, they say that we are not doing enough, that we're not hard enough on people.

But we do have an Air Quality Management Plan for the basin and by late 1991, we'll have a new tougher version of that which will have a lot more transportation control measures in it, rules designed to work with the CARB's new regulations on automobiles.

A number of their rules involve clean fuels and advanced technologies. If you own a fleet of vehicles which has 15 cars or more, if you replace your vehicles starting next year you'll have to include a certain percentage of low-emission vehicles, not 'ultra-low' but 'low'. If you do have some 'ultra-lows', you don't need as many 'lows'. If you have some zero-emission vehicles you will need even fewer 'lows'. This is the way we're going to get the fleets into the low emission area.

By the end of the decade, we'll have 26 percent of the light-duty vehicles in our basin running on electricity.

Initially, urban fleet users will favour electric vans because they have the short distance, in-town kind of duty cycle and it turns out that the way those things work, with lots of starts and stops; electric vehicles would be great and will sell well. And if you operate in a hilly area, when you come back down the hills, you'll be able to regeneratively put energy back into the batteries that you used to climb the hills. Sort of a 'grade-retard' braking system.

They say the low maintenance and higher reliability of electric vehicles are expected to further enhance their value for deliveries and for urban transportation in general. It's expected the commercial operators would be the first to obtain hands-on knowledge of EV technology and maintenance procedures and eventually electric vehicles will gain acceptance with the general public and will be able to compete directly with regular vehicles.

I've been invited to a number of meetings like this recently, and, do you know, there always seems to be a number of gentlemen outside displaying their electric cars.

For example, I went to a large technical meeting in downtown Los Angeles recently and a gentleman showed up with two beautifully-crafted electric vehicles. One of the delegates, Mr. Marvin Braude, the same gentleman that was originally scheduled to address you today, went out and looked at them and came back to one of our accounting people to ask if there was still a bit of money in the budget. He said, "Why don't we buy two of these?" So he asked the owner, "Say, how much are these?" Hearing they were only $15,000 each, he says, "Buy two." So he bought two of these hand crafted vehicles and we'll be getting them delivered in a few months. So we've got a start on our ZEV fleet already.

It will be interesting to see how those vehicles stand up to day-to-day use. But, as you know, there are still substantial barriers before the Los Angeles metropolitan area achieves wide spread use of EV's.

A second approach our District has taken is to expedite the development of commercial electric vehicles. This involves sharing some of the inherent risks of development and demonstration. And, as you know, we are involved with improved battery technology. We have a gentleman working with us who is a member of the same fuel cell group you're with, Geoff, (Dr. Geoff Ballard). I hope that works out well and I hope we can bring you some money to facilitate fuel cell research here in B. C.

But the new battery consortium is a very good step towards resolving, the viability of electric vehicles. The battery is going to be the key. I believe that the key technical innovation is going to turn out to be a successful combination of a fuel cell and batteries. We may be able to get there within our time frame and be able to achieve our air quality goals.

They also mention that, independent of the batteries and motors, the frame and the bodies should be reconfigured so you build the entire package from scratch to be a battery-operated vehicle.

I mentioned this to a gentleman here yesterday and he said, "That's true, except people are used to the dashboard layout and controls on the steering column and everything else, so we don't want to change it that radically." But if you recall, automobiles looked like horseless carriages for many, many years.

Our technology advancement program is closely monitoring, and, in some cases assisting, developments in hybrid EV technology. While they may not meet the CARB ZEV definition, hybrids have excellent potential to achieve California's ultra-low-emission vehicle standards. This kind of technology will enable motorists to operate their vehicles solely on battery power most of the time, especially when driving in urban areas, where ambient air quality is the worst.

The recent worldwide activity in hybrid technology has been encouraging. In addition to prototypes from Unique Mobility and Clean Air Transport that will be provided in response to the Los Angeles initiative, GM recently unveiled the HX3. This hybrid vehicle features AC induction electric motors that are powered both by batteries and by a small, constant-speed internal combustion engine. Unfortunately, GM has not publicly discussed a production time frame for the HX3, as is the case with the all-electric 'Impact'. But we have heard that GM has formed a new strategic business unit to market EVs in the near term. I applaud GM's concept, but it's time for the manufacturers to move EVs off the drawing board

and onto the showroom floor.

The point I wanted to make and the reason I asked if there were automotive people here, is because Southern California is a supermarket just waiting to get its hands on these cars so we can sell them. The other comment, is that the zero-emission vehicle is not really truly zero-emission unless your electric power plants, which charge the batteries, are relatively low-emission or are sited outside the Basin.

Our South Coast Air Quality Management District Board has already done a lot to reduce the emissions from our power generating plants by getting scrubbers installed. And we import a lot of power. I understand that we take some power from the Bonneville Power Administration, and that B.C. Hydro backs up Bonneville, so I suppose we buy interruptible power from here from time to time, to reduce emissions down in Los Angeles, and help us achieve compliance with the clean air plan.

So with that, I'll answer any questions you have. I'm delighted to have been here, it's been a lot of fun. As I see it, everybody here seems to have already decided that electric vehicles are the way to go. We owe it to our citizens down in our air basin to clean up that air, and with automobiles the source of 55 percent of the emissions, electric vehicles could make a tremendous difference in our ability to achieve that.

Thank you very much.

Questions Directed to Henry Morgan:

Question: If there's a massive shift to electric energy driven vehicles, where would the energy to power these vehicles come from and what would the environmental consequence of supplying that energy be?

Henry Morgan: Well, now, if we can go hybrid vehicles or to fuel cells, that won't be as big an electric battery recharging load as would be the case if everyone bought a battery-driven electric car.

I'm told that the charging load of a typical electric car with a nearly flat battery is about 4 kilowatts, peak. If 10,000 vehicles were to all plug in at once, the total load would be 40 megawatts at the receiving end, maybe 46 megawatts at the power plant. That tails off with time. If everyone's battery charger came on at midnight, the charging load would be down to zero by about 6 am.

That's not a very big load for a utility to handle. And if you offer off-peak power for charging batteries, the existing generating plant could probably handle the charging load without requiring any plant additions.

If we had to site new generation in the Basin to generate this power, yes, I think there potentially could be emission problems, particularly CO_2. When I talked to Edison about this they just kind of rubbed their hands together. They think its a great idea that people will be using more power. And they believe that, for a price, they can still remove any emission you care to name.

I think that question might be better directed to the power producers who may have looked at this as a future problem that they'll have to solve. I'll defer that question to them.

Question: With regular leaded gasoline in Los Angeles currently selling for about 90 to 95 cents per gallon, what is the incentive for drivers to change from internal combustion to electric?

Henry Morgan: Unleaded gasoline now sells in L.A. for 89 cents a gallon, believe it or not. That's for unleaded, the leaded is a little bit less. Believe it or not, diesel still costs about a dollar and a half a gallon. I was driving a methanol-fuelled vehicle the other day. Methanol costs about 70 cents a gallon. Of course, the mileage was a little bit lower, but still the cost per mile came out about equal.

At those prices, you're not going to get many to even look at electric vehicles. There has to be an economic incentive and everybody's talking about raising the price of fuel.

Like many of the other problems we address today: electric power is too cheap here in B.C.; water is too cheap in California; why don't we raise the price so we can do some economical things with it?

We may have to structure some sort of a situation which will give a solid economic advantage to using an electric vehicle. Because, you know, right now there's about three to four thousand dollars premium to buy an electric vehicle

for commuting, at least.

Question: Is an electric car a temporary technological fix? For people-moving, isn't public transportation preferable? Wouldn't light rail transit be better? Have rational comparable studies been carried out between EVs and LRT?

Henry Morgan: Well, we have a terrible addiction to the automobile, and if L.A.'s population had grown before the automobile was invented, maybe we wouldn't have this problem, but it didn't turn out that way.

At one time, we in L.A. probably had the finest intra-urban transportation system in North America with the 'Red Car' system, and it was destroyed because the horses were smart enough to get out of the way and the automobiles weren't.

And so finally they decided that the trains had to go and they'd put people on rubber tires and into gasoline-powered automobiles. Now, to take people and move them back into public transportation in Southern California is going to be a difficult, long-term job.

My guess is that it won't be the air quality that will do it, it'll be the congestion that will finally do it. Today our freeways are bumper-to-bumper virtually all day, every day. Clear at night but plugged all day, every day. So I think the basic ability of being able to get from where you live to where you work will either put you into rail or some type of transportation like that, or maybe in car pools, hopefully, burning efficient, clean fuels.

Question: Where will Los Angeles get the power to charge all the batteries for electric cars?

Henry Morgan: I think I already answered that one. But I'll refer you to the Edison Company for a precise answer. They say they can do it and they say they won't have a problem with battery-charging loads in Los Angeles.

Question: The remaining questions are along the same lines: "How do you charge the batteries and how do electric cars solve congestion problems?" Perhaps you can respond to the rest of them in the Proceedings of the Forum.

Henry Morgan: Very good. Thank you all very much. It's been a lot of fun. Keep this weather going!

Thanks by Einar Field: Well, Mr. Morgan, we may not have all the problems in Greater Vancouver that you described to us, but perhaps it's a good time to take preventive action before we do have them. So we'd like to thank you very much for outlining some of the issues and looking at some of the remedies.

Thank you very much for agreeing to come to our Forum.

Questions Answered by Henry Morgan after the Forum:

Question: What will be the effect of EVs on Los Angeles electrical consumption? Where will the extra electricity come from?

Henry Morgan: This question is somewhat controversial and different estimates have been derived by various sources. Southern California Edison estimates that up to one million electric vehicles could be charged daily with their existing generation if they were to be charged during off-peak hours. The South Coast Air Quality Management District (SCAQMD) estimates that the total basin electricity grid could accommodate up to 1.4 million EVs without having to build new power plants.

Of course, if the basin's entire passenger fleet of several million vehicles were to be converted to EVs, there would be a need to increase electricity supply significantly by building additional power plants, either in or out of the basin. Out-of-basin power would probably come from some combination of nuclear, hydroelectric or coal-fired power plants.

Question: Will you enlarge on the ability of the South Coast Air Quality Management District to raise funds and make it less dependant on other Government agencies' control?

Henry Morgan: The SCAQMD receives about 90% of its annual revenue from fines and fees paid by stationary-source polluters. The remaining revenue comes from state and federal subsidies, grants and other sources. In recent years, additional revenue has been generated for air pollution control in the Los Angeles Basin through the California Department of Motor Vehicle registration fees.

These figures show that the SCAQMD is essentially independent from control by other

government agencies, at least in the fiscal sense. Of course, close interaction is maintained with the federal Environmental Protection Agency, the California Air Resources Board, and other key government agencies.

Question: Why not introduce cash incentives to get people to adopt minimum-pollution vehicles: reduce or eliminate the cost of license plates; free downtown parking for EVs; offer low or zero-interest loans for purchase of these vehicles; free recharging at your parking spot at work; reduced or eliminated sales taxes, etc.?

Henry Morgan: Incentives are recognized as a key part of the plan for achieving widespread adoption of EVs in greater Los Angeles. Some legislation has already been adopted, such as the SCAQMD's Regulation XV (rideshare rule), which offers a 5:1 tax credit in calculating a given work site's average vehicle ridership for every EV used as a commuter vehicle. Other legislation at the state level has been adopted or is under way that will provide incentives for public and private businesses to purchase and use EVs, and to provide tax breaks for individuals.

For further information regarding state, local and federal legislation involving EVs, contact Mr. Bill West of the Southern California Edison Company. He is an excellent source of information on EVs, and can be reached by telephone at (818) 302-9534.

Question: A recent ruling by the California Air Resources Board calls for the introduction of ZEVs in California by 1998, and appear to be a key supporter in encouraging their commercialization. In your opinion, if these rulings were repealed or deferred, would the current consumer trend towards environmentalism force automakers to build and market electric vehicles anyway?

Henry Morgan: The SCAQMD sees no reason at this time to believe that the California Air Resources Board will repeal or defer its ZEV mandate. However, if that were to happen, it is doubtful that consumer choice, as we now see it, would be sufficient to encourage the automakers into marketing EVs, since large production runs are needed to make EV manufacturing profitable.

It is impossible to predict whether or not the 'Green Movement' will succeed in mobilizing large numbers of people into lobbying the automakers to make EVs available.

Question: Who can I contact to learn more about electric vehicles in Los Angeles? Who can I write to at General Motors, Ford, and Chrysler? Russ Galas, Edmonton Power.

Henry Morgan: Try the following individuals:

Bill West, Southern California Edison (818) 302-9534
Richard Schweinberg, Southern California Edison (818) 302-8295
Jerry Enzenauer, L.A. Dept. Water & Power (213) 481-5698
Roland Risser, Pacific Gas & Electric (415) 866-5506
Jerry Mader, Electric Vehicle Development Corp. (408) 253-5262
Brad Bates, Ford Motor Company (313) 594-7957
George Shishkovsky, Chrysler Motors (313) 252-6572
Ken Winters, Pentastar Electronics (Chrysler Motors) (205) 895-2370
Robert Bish, Delco-Remy (General Motors) (317) 646-3979

Question:
How many vehicles are there in Los Angeles today?
How many electric vehicles are there in L.A. today?
How many vehicles will there be in L.A. by year 2000?
How many EVs will there be in L.A. by the year 2000?

I believe you estimated 40,000 EVs by 1998. If this is less than 10% of the total, will it make much impact on reducing vehicle emission pollution?

Henry Morgan: There are approximately 8.2 million motor vehicles in the Greater Los Angeles area today. The number of electric vehicles today is not known, but it is safe to say that only a very small percentage (perhaps a few thousand) of our passenger cars run on electricity. Virtually all the electric automobiles are conversions, built by private inventors and EV enthusiasts. There are only a handful of EV prototypes being driven in Los Angeles today that have been converted to electric power by established automakers.

By the year 2000, it is projected that there will

be about 9.2 million vehicles in the Los Angeles area, including all types of on-road vehicles. The SCAQMD's 1991 Air Quality Management Plan (AQMP) targets 200,000 of these to be powered by electricity. This is five times more than the 40,000 EVs required by the CARB ZEV mandate.

The emission reductions resulting from operating 40,000 to 200,000 EVs in the year 2000 will depend on whether these vehicles replace old or new gasoline-powered vehicles, and how many miles travelled by combustion-powered vehicles are replaced by 'EV miles'. It will also depend on:
(1) the ability of EVs to efficiently convert AC power from the wall plug into electromotive force,
(2) the fuel mix of power-generation grid,
(3) the type of emission controls applied to the power utility, and other factors.

The SCAQMD has now adopted Rule 1135, which will require progressively lower NO_x emissions from Basin powerplants. The benefits of EVs, in terms of reductions in carbon monoxide and hydrocarbon emissions, as well as toxic air pollutants, will be fairly dramatic relative to even the cleanest combustion vehicles.

Question: I'll drive an electric car if it has:
(a) a great stereo;
(b) a sun roof;
(c) and I won't be laughed at by others.
Are you confident your new electric cars will satisfy me?

Henry Morgan: Advanced commercially-supplied EVs are expected to have all the amenities of today's vehicles. However, EV users soon learn that use of electrical accessories directly translates into reduced EV driving range. This is especially true of air-conditioning. Running an air-conditioner continuously can reduce the range of a current-technology EV by up to 20 percent. However, the niche targeted for EVs in the early years of transition involves using them to drive less than 60 miles a day, and they are expected to perform quite well in this regard, even with the sun roof open, the air-conditioning on and the stereo playing.

Nobody will laugh at EV users; on the contrary, we expect them to become a status symbol, at least until they become common. But the very issue of customer satisfaction is one of the main reasons that the automakers have been so cautious and conservative about marketing EVs. They are understandably concerned that EVs not be sold before they can meet basic consumer demands for performance, reliability, durability and cost.

Question: How did you arrive at your estimate that the 'price of pollution' is now $10 billion per year in California?

Is this what the government spends to clean up or prevent pollution, or does it include the research and development budget to solve southern California's air pollution problems?

Henry Morgan: Actually, the ten billion-dollar cost estimate for air pollution refers only to the **Los Angeles Basin**, not the entire State of California. This cost estimate was reported in a detailed study conducted by Jane V. Hall, a University of California professor of economics. It refers to the annual cost to Basin residents in terms of adverse health effects caused by air pollution, the cost of medical treatments, loss of productivity from lung-related problems, etc. It does **not** include allowances for damage to agricultural crops and buildings, or loss of tourism dollars, reduced real estate values, etc., arising from air pollution. Nor does it include the cost of cleaning up pollution effects or conducting R&D on new technology. So the real cost of air pollution in Greater Los Angeles nowadays must be well in excess of ten billion dollars per year.

Question: California has a shortage of electrical energy now. If all the commuter vehicles were converted to electric drives, how would you get the electrical energy to charge the batteries?

Henry Morgan: I believe that this question was answered earlier. But it is important to recognize that not everyone would agree that there is 'now a shortage of energy in California', at least not in the Los Angeles Basin.

The SCAQMD also expects that energy conservation measures could reduce today's household electric energy use by about 15 percent in the year 2000.

Question: In the United States, 60% of electricity is produced from coal. I read that 50,000 people will die in the US in the next decade from coal mine pollution. How can you describe an electric vehicle a ZEV if the emissions are only moved upstream to the coal-fired power plants?

Coal combustion emits more CO_2 than burning oil or natural gas.

Henry Morgan: The ZEV definition does not include electric utility generation emissions caused by battery charging, because other fuel/vehicle technologies also do not allow for fuel-production emissions by, say, oil refineries, etc.

Of course, air pollution control officials are very concerned with the air quality implications of recharging the batteries of electric vehicles, and much is being done to address this issue. In the Basin today, no power is generated through coal burning, as natural gas makes up more than 95% of our utility fuel supply. However, a small percentage of Los Angeles' power today is generated out-of-basin by coal-fired powerplants.

It is true that the global warming implications of burning coal are significant, but eliminating CO_2 from the tailpipes of motor vehicles can play a huge role in mitigating global warming.

It is important to note that it is easier to control emissions and mitigate public health concerns when dealing with a few large, remote stationary sources rather than millions of mobile sources. By their very nature, vehicles emissions are hard to control because:

(1) they must operate in continually changing conditions,
(2) they emit increasingly more pollutants as they age,
(3) they are maintained (or not maintained) by members of the public,
(4) they emit where the population is most concentrated.

This is generally not the case for power plants, which are operated under relatively constant conditions at higher efficiency, are maintained by trained technicians, and can be remotely located. Nonetheless, power plant emissions must be progressively reduced, especially if we need to generate additional electricity to recharge electric vehicles. This is being done by the SCAQMD through Rule 1135, which will reduce in-Basin NOx over the next decade by 93 percent.

Partnerships in Education

Tazeem Nathoo

Manager, Employment and Human Resource Planning,
B.C. Hydro

Introduction of Tazeem Nathoo by Einar Field

We continue to focus on the importance of education and we now add a new dimension, with industry taking an active part and sharing some of the responsibility for education of our young people.

Many organizations see this as a major strategic issue for several reasons. And here to speak about our Partnership in Education is Tazeem Nathoo.

Tazeem Nathoo is the Manager of Employment and Human Resource Planning at B.C. Hydro. She is also responsible for the Employment Equity and Partnership in Education Programs. Prior to joining B.C. Hydro ten years ago, she was staff manager at Harrods, in Knightsbridge, England, and Supervisor of Personnel Placement for the Insurance Corporation of British Columbia.

She received a Bachelor of Arts degree from the University of Leicester and is a member of the Board of Directors of the North Shore Family Services Society. Please join me in welcoming Ms. Tazeem Nathoo.

Partnerships in Education

Thank you, Einar. Good afternoon, ladies and gentlemen. I am really pleased to be here today, because the subject I'm going to be talking about, Partnerships in Education, is of great interest to me and, I hope, to all of us.

Before I begin, I must say that when I heard Lon Mandrake this morning, I was really excited and inspired. I just wish he was my kids' teacher!

B.C. Hydro's Partnerships in Education program is part of our corporate strategy. It involves an integrated and focused approach that includes addressing our human resources requirements, carrying our Power Smart message and raising awareness of electric safety in the education sector.

Today, however, I will speak to you on the issue of human resources requirements. I am convinced that education is vital to the future of not only B.C. Hydro, but also for the province of British Columbia and for Canada as a whole.

Education is the key to our prosperity and success. For example, it takes the Japanese two years to design and develop a car. In North America it takes four years to produce a similar product. What is the Japanese competitive advantage?

It is not capital, nor is it technology. It is innovative, skilled, and productive workers. People are our most valuable resource, and also our most renewable resource. I believe that education is the tool which enhances that resource. Through education, our work force can attain the skills necessary for us to remain competitive in an age of advancing technology and globalization of markets.

We in business have a major stake in the output of the education system. Supporting education should not be viewed as a charitable donation or an expense, but rather a vital investment in our future. It's a matter of economic and social survival for business and for the country. If we are to stay competitive and continue to maintain our standard of living, we must have individuals who can make our business successful in an increasingly global economy.

It is certainly a step in the right direction that all the stakeholders, business, government, and the educational community, acknowledge that education is a key factor to holding our country's competitive position from slipping any further. But, there is a growing recognition that the Canadian education system is also in crisis. Canada spends more per capita on education than any other country except Sweden, yet current trends indicate that Canada is falling far behind our competitor nations in educational achievement.

For instance, 30 percent of Canadian students entering Grade nine drop out before completing secondary school, compared with 3 per cent in Japan. Only 72 percent of our 17-year olds are still enrolled in some form of education or apprenticeship program, compared with 89 per–cent in Germany, and 94 percent in Japan.

In recent tests of achievement in secondary school Math and Science, Canada ranked eleventh out of 13 nations tested. Equally alarming is the declining enrolment in science and technology courses, down 12 percent in secondary schools and 26 percent in community colleges. Girls are dropping math and science at an early age, during a time when careers and demands for these skills is increasing. This trend, combined with an aging population and declining birth rates, could lead to acute shortages in our skilled work force by the year 2000.

Many of us feel that talking of shortages is an alarmist attitude, particularly as we can point to the unemployment statistics. Well, hopefully unemployment statistics will improve, but the reality also is that there is not a complete alignment between the skills of the unemployed workers in general and the needs of business and industry today.

The Dalcor study, completed in 1990, projects a shortage of 50,000 engineers in Canada by the year 2000 if no corrective actions are taken. Where will we get the people from to remain competitive?

In the past, we have imported resources, but this will not be the answer in the future, as most developed countries expect similar shortages. For example, the US Bureau of Labour Statistics has predicted the US demand for scientists and engineers will increase by thirty–six percent between 1986 and the year 2000.

Let me now give you some information in the context of B.C. Hydro. In 1988, we completed a five-year forecast which indicated that two-thirds of our employees were 40 years of age or older. As well, during the 1980s recession, we didn't hire apprentices or young engineers or technologists. In fact, we had to lay off a number of them. We are now faced with the task of replacing a large number of employees within 15 years.

Our needs are on many fronts. Trades people, engineers, managers, and so on. Of the 1000 people we will be replacing through retirement in the next decade or so, we expect to hire at least 300 trades people.

We have developed and implemented a proactive human resource strategy, 'Building Team 2000', which I'm sure many of you have heard about. This is designed to ensure that we will have the employees with the skills, knowledge, and attitudes, to excel in accomplishing our corporate mission and objectives. But if we are to be successful, we recognize that the quality of education plays a critical role and that we need to take immediate action on this issue.

Now, at the same time that our human resources projections led us to incorporate education and life-long learning into Hydro's strategy, our Power Smart program was leading us to the same path. Let me explain briefly why.

As you have already heard, our Power Smart program promotes the efficient use of energy. In fact, we have an ambitious vision of changing the energy use ethic in this province. We have several means of influencing the amount of energy everybody uses, and Derek Henriques has already pointed out to you what those are this morning. Of all the methods, the education strategy is the most critical, because it will assist in bringing about fundamental and long-term changes in people's behaviour.

Once one understands and accepts a concept, then an individual will change his behaviour accordingly. A portion of our Power Smart education efforts therefore are geared at the classroom in the interest of changing the attitudes and behaviours of our future customers.

Promoting the efficient use of energy is complemented by another message, which deals

with the encouragement of electrical safety. Integrating the human resource message with Power Smart and safety is a strategy for focusing our approach and ensuring that we use our resources in the education sector wisely, but it's an ambitious approach.

We realize that stakes are high, that challenges are great and the time is short. Our future employees and customers are in today's classrooms, and the impact of our crisis in education is already beginning to affect companies in British Columbia.

For example, a 1990 Conference Board survey found 70 percent of the 626 companies that they surveyed had a significant problem with functional illiteracy. This comes at a time when we are facing increased competition. Today's technology is such that we need informed employees and people who are technically sophisticated, computer–literate problem solvers and at the same time, our expectations for their personal attributes are also increasing.

Effective education programs benefit everyone, but don't happen by themselves. All the stakeholders must get involved. We at B.C. Hydro want to take action and be part of the solution.

We have taken action on a number of fronts. Our actions are geared to ensuring that the message we are taking out to the educational community is strong and consistent. We're building alliances and partnerships with all the stakeholders. This is the same principle that we're developing with all our business associates.

At present, we are involved in over 30 projects that deal with a variety of issues at all levels of education, from elementary schools through to universities, to external agencies and other business organizations. All our efforts are aimed at stressing the importance of graduating from high school, completing math and science courses, committing to life-long learning, and having good communication and team-playing skills.

We've been successful in forming and participating in many innovative partnerships and joint ventures, which inevitably lead to adding value for all the partners concerned.

Just to give you a highlight of two or three of these projects: we have formed partnerships with elementary and secondary schools through our 'School Partnership' program. This is a pilot project with two schools in Vancouver at present. A group of volunteer Hydro employees work with teachers on mutually beneficial activities. This includes working on environment and Power Smart themes, safety, making science and math interesting for boys and girls, and encouraging students in every way possible, including tutoring.

This is a long-term relationship which fosters greater understanding between the classroom and the business world. Future plans include mentoring, exchanges with teachers, and any number of other options. Our plan for the coming year is to use our network of offices throughout the province to connect with as many schools as possible.

We also have a major high school campaign that involves making presentations and giving information to students on why they should and must complete high school. We are making them aware of terrific opportunities available in trades and technology. We are urging them to keep their options open by completing math and science courses to the Grade 12 level. Our message to the school students is that in order to compete for almost all the jobs in Hydro, including the trades apprenticeships, they will require completion of math and science courses at the Grade 12 level.

Our partnership with Science World reinforces the same message in a 'fun' way. We have also connected with B.C. colleges and universities. We have contracted with academics and developed a business management course for B. C. Hydro managers. Last week, we met with Kwantlen College to develop programs that would meet our needs for trade and technology.

Through our Employment Equity Program, we are encouraging women in particular to consider careers in trade and technology. At the university level, one of our active partners, Dean Meisen from UBC's Faculty of Applied Science, is present here today. He has been most willing to visit us at Hydro and we've met a number of times to discuss our specific needs and their specific capabilities. In a similar manner, we've met members of other institutions as well. Our employees act as guest lecturers at all these institutions from time to time.

Having developed our ideal candidate profile, which outlines what we are looking for in prospective employees, we're sharing this information so that the education institutions are aware not only of the skills that we require, but the attributes we need.

At the Provincial Government level, we have collaborated with the Ministry of Advanced Education to standardize educational prerequisites for apprenticeship programs. We have met with the Ministry of Education to discuss how we can assist them with the Year 2000 framework for learning, and have volunteered to participate on a Business Advisory Council.

Our Power Smart group is working with the Ministry of Energy to explore energy education program development. They have also worked in partnership with the Ministry of Environment to deliver the energy conservation and environmental message. We are encouraging other businesses to get involved and form a coalition. Our Vice-President of Human Resources, Einar Field, has participated in a Forum at the B.C. Business Council, and is also a member of the Conference Board of Canada National Task Force on Education.

As Mr. Wyman mentioned earlier, we have revised our scholarship program for post-secondary education. The scholarships are now designed to be an incentive for young men and women who excel in obtaining the skills, knowledge, and attitudes that we require. We capitalize on every opportunity to get our message across. The co-op and summer students that work with us throughout the year, and there are a large number of them, are terrific ambassadors for Hydro when they return to campus.

We are beginning to find that the halls of education institutions are packed on career days when we are visiting. It was really exciting for us that we succeeded in hiring the best of a good combination of male and female graduates in Engineering this spring, but I assure you we're not sitting on our laurels.

Within B.C. Hydro, we are encouraging our union employees and retirees to join our 'Partners in Education' program. We are raising awareness amongst employees through our newsletters and our 'Partners in Education' month planned for this October. We also plan to set up programs where employees can volunteer to be men–tors, tutors, and public speakers on this important issue. Internally, we also offer scholarship programs to encourage employees to continue to improve their skills. In fact, our training budget is $12 million, which works out to six percent of our total payroll. These are just a few examples of our efforts on the education front.

In conclusion, at B.C. Hydro, we feel that we are breaking new ground and making progress, but many challenges lie ahead. The time, however, has come for us all to take action collectively. The alarming education statistics, combined with the necessity to increase our productivity and capitalize on technology is our incentive for action. If we Canadians are to maintain our standard of living and be responsible stewards of our planet, we must enhance the education system. Stakeholders must work together, not in isolation. We have to transcend our petty territorial focus, look at the big picture, and work together to achieve results. Many of us have started on this road, but we could be much more successful by joining forces and combining our efforts. I invite you to join us. No one can afford to remain a silent partner and I urge you to leave this conference with the determination and commitment to get involved and be a part of the solution and I welcome your suggestions.

Thank you.

Questions Directed to Tazeem Nathoo:

Question: Tazeem, we have some questions for you. What is Hydro doing to advance women into management positions?

Tazeem Nathoo: This is my pet subject ... you couldn't have asked anyone more interested in this issue. I am, as you know, the Manager of Employment Equity at B.C. Hydro, and in the last three years we've done a number of things to advance the position of women. We discovered when we did our five-year forecast, that the percentage of women in management was actually quite low when we started. Since then we've offered scholarships to women, for courses at Simon Fraser University in management. We have also worked jointly with UBC to develop an executive program that's a Hydro and UBC joint program that some are participating in.

We had a major awareness campaign in B. C. Hydro. We had a number of career symposia where we invited, first of all, Hydro women that were successful to serve as role models. We invited external women that have had successful careers to talk to our female staff, and we have also tried to make the whole organization aware of what's going on. And I'm really excited, because three years ago, when we started, the percentage of women in senior positions was something like three to four percent. Within three years, there are now double that number, so in fact, I think the number of women in senior positions now is something like 96. And we're doing very well. We have our First Vice-President, that's Darlene Barnett, of Legal Services, and I think she's in the audience here today. Does that answer your question?

Question: What fraction of B. C. Hydro's engineers are women, and further, are there special provisions to help those combining professional careers with raising a family?

Tazeem Nathoo: That's another very exciting topic. First of all, if you ask me for specific numbers, I'm really not sure how many women we have. Suffice it to say that there are very few women engineers on staff today. We did have a few more women engineers during the early 1980s, but then during the recession, because they were often the most recently hired, unfortunately, we lost some of them. Since then we've made a real effort and this year we hired an almost equal number of men and women when we went out recruiting at campus.

Now, addressing the second part of the question, of what are we doing for women trying to combine professional careers with raising a family. Well, we're doing a number of things on the family and work situation, and this is an issue I think that's not a women's issue only. It's an issue for all families and all businesses because we no longer have the traditional family where you see a picture of the husband waving goodbye to the children and the wife stays at home and cooks supper and so on and so forth.

In fact, that traditional typical family with two children, husband working, is on the way out. Most families now have either two people working or they're single–parent families, so their productivity is really affected if they are not able to take care of the family needs well.

At B.C. Hydro, we've done a number of things. We've introduced a number of policies, which include flexible working hours, the possibilities of people job-sharing, or working part-time and working from home by means of 'telecommuting.' We have introduced a daycare referral program recently, and I'm really excited to tell you that when we move to Burnaby to the new Edmonds office building, we will also have on-site daycare nearby.

Thanks by Einar Field: Thank you, Tazeem. I think Hydro has made a good start in the Partners in Education program and there's more to come.

Questions Answered by Tazeem Nathoo after the Forum:

Question: What initiatives has B. C. Hydro undertaken to become aware of the current changes in the aims and practices of education? What level of consultation with professional organizations such as the B. C. Teachers' Federation or the Provincial Specialist Associations?

Tazeem Nathoo: The Partners in Education program has developed an informal network with a variety of educators. These contacts keep us abreast with the current issues and changes in education. As well, we reviewed the Year 2000 document and provided the Ministry of Education with our feedback. Most recently, we attended a Colloquium on the Year 2000 and the Graduation Program.

Question: Teachers already complain of overload. How can they take on the task of teaching Power Smart and environmental awareness without dropping some existing, and presumably valuable, part of the curriculum?

Tazeem Nathoo: We are not asking that our programs become separate components of the curriculum; rather, we are developing materials that complement and can be integrated into the present curriculum.

Question: I believe the single most important factor in motivating children to learn is the importance parents place on education, and their involvement and support of their children's schools. If the Year 2000 is to succeed, parents will need to spend time in the schools. Does B.C. Hydro offer parent leave for school involvement?

Tazeem Nathoo: I agree that parents do play an important role in education. B.C. Hydro offers very flexible working arrangements. Telecommuting, flexible working hours, a generous vacation package and additional flexible time for days off allow parents the opportunity to spend time in the classrooms if they so desire. But no, Hydro does not offer a formal 'parental leave for time in classrooms' policy: our flexible working arrangements and benefits can accommodate this need.

Question: Is it not of paramount importance to get the best possible **people** in positions of authority or prominence rather than emphasizing balances based on gender or other criteria?

Tazeem Nathoo: Yes, it is of paramount importance to select the best possible person for all positions. Because of that, we need to consider people from **all** sectors of the labour force, and we need to reach out to members of groups who may not be aware of the opportunities available and the skills required.

We are not emphasizing balances based on gender or any other criteria. All selection decisions are made on the basis of ability and potential. However, we believe that a work force made up of people from a variety of backgrounds brings more creativity to the work place and ultimately better customer service.

Question: It is easy to blame the education system for the lack of knowledge and understanding exhibited by some individuals in our society. As many of us know, and you alluded to this, even the experts can't agree on causal relationships. Since you seem to be of the opinion that poor teaching and schooling causes or contributes to lack of understanding, please advise those charged with the responsibility of schooling in this province what we ought to be doing to improve the education of our young people?

Tazeem Nathoo: We are not pointing the finger at the education system. Everyone is a stakeholder in education, business, government, educators, parents and students. No one sector is responsible: education is a partnership and we must all work together to improve our education system.

Comments on the Discussion Groups by Einar Field: Before I introduce the last two speakers for the afternoon, let me talk a little bit about the discussion groups. You have listened to a lot, and in an hour or so, you'll have a chance to make your own contribution to this discussion. I urge you to participate in this afternoon and tomorrow morning's discussion groups. Exchange ideas on how energy education should work and tell us how Hydro should be involved. We have a number of volunteers who have agreed to help chair these meetings, and I'd like them to stand up now so you can identify them. So, volunteers chairing these groups this afternoon and tomorrow, will you please stand up? Thank you very much.

I have a couple of housekeeping notes. Because of the number of people involved in the discussions, we will have to spread the groups out into more rooms. If you have a group number, you may find that the room listed on your card may not be correct. The new locations will be posted near the registration area, along with a list of the members of the group that you're in. Please check before the discussions start. If you're not sure what group you are to go to, talk to the people at the registration desk. And shortly, Mr. Jim Savage will be informing you more about the discussion groups. Thank you.

New Directions for B.C. Energy Policy for the '90s

Peter Ostergaard

Assistant Deputy Minister, Ministry of Energy, Mines and Petroleum Resources

Introduction of Peter Ostergaard by Einar Field

The problem of deciding how the components of the energy mosaic should come together is the task of the provincial government. The energy policy, the public awareness level, and finally the impact of policy on the environment, are all interdependent to some degree, and are influenced by the leadership of government.

Here to speak to us on 'New Direction for B.C. Energy Policy for the '90s', is Peter Ostergaard.

Peter Ostergaard is the Assistant Deputy Minister for the Energy Resources Division of the Ministry of Energy, Mines and Petroleum Resources. Mr. Ostergaard holds a master's degree in Urban Geography from UBC. He has taught at regional colleges in Prince George and Nanaimo, and has been in charge of economic development and long-range planning for the City of Prince George and was a consultant in land-use economics, regional development and energy before joining the Ministry of Energy, Mines and Petroleum Resources in 1985.

Please join me in welcoming Mr. Peter Ostergaard.

New Directions in B.C. Energy Policy for the '90s

Thanks, Einar. The major TV networks have a name for this time slot, so when planning our presentations, Warren and I felt that it would be appropriate to use slides. So perhaps the lights could be dimmed for those of you who need to rest your eyes. Could we have the first slide, please? (Slide 1).

I want to talk to you about B.C.'s new energy policy document, **New Directions for the 1990s** but we need first to go back at least ten years, to put this document into context.

In 1980, really only a decade ago, the energy scene in B.C. and Canada was dominated by supply uncertainties. B.C., like other industrial economies, had experienced the dramatic oil price shocks and supply shortages of the 1970s. (Slide 2). As a result, federal energy policy in 1980 tried to ensure security of supply through the Canadianization of the industry, isolation from global oil markets and by taxation. It didn't work. The unpopular federal National Energy Program was dismantled over the decade, but it's still blamed by many economists as the source of Canada's economic woes. You may have seen Sylvia Ostry on the Journal a couple of weeks ago when she was asked the cause of Canada's current economic malaise, in terms of lack of competitiveness, and lack of R & D in the private sector. She answered "the National Energy Program."

Provincially, our so-called 'sunrise document', **An Energy Secure British Columbia**, was published in 1980. As its introduction noted, the document served as an initial framework for evolving policies and programs.

Conditions changed noticeably after 1980. The recession reduced energy use and reduced oil prices.

Over the decade, a consensus developed in favour of the determination of energy prices by market forces. Don't forget, when the decade began, B.C. Hydro set its own rates, the provincial government set the domestic price for natural gas, and the federal government set all oil prices

and the export price of natural gas. So, towards the end of the 1980s, deregulation, market pricing, and increased competition were opening up new sources of supply and new markets.

Also, by 1990, new and more urgent priorities were attached to energy efficiency and environmental protection. (Slide 3). When our committee began meeting about a year ago, four goals kept emerging over and over in our discussions:

- to provide enough energy to meet our needs.
- to minimize waste.
- to protect our health and our environment.
- to reduce our use of non-renewables without stalling economic development.

These goals manifested themselves in our four related themes for energy policy in the 1990s; green, lean, clean and wean. Two themes, **Energy Efficiency** and **Clean Energy**, reflect our new policy priorities. The other two, **Secure Energy** and **Energy for the Economy**, carry over from the early 1980s. (Slide 4)

Now, balancing these goals requires difficult trade–offs, and from time to time, government intervention in what is generally a market–oriented energy policy. We continue to be successful, for example, in reducing oil's share of B.C.'s energy needs from about 44 percent ten years ago to 35 percent today. Natural gas and electricity picked up the slack, but we also want to see a rise in hog fuel's less than 20 percent share.

I'd like to turn to each of the four themes. I'll only be noting a couple of the policies under each one, so please refer to your very own copy of **New Directions for the 1990s**, which is included in your registration kit, and for more information on the many policies under each one.

Efficient Energy (Slide 5)

B.C. is a heavy consumer of energy, due to the predominance of energy–intensive industry in our economy. In 1990, the province used 29 percent more energy per person than all of Canada and 60 percent more than most other industrialized economies of the world. (Slide 6).

However, since 1980, energy use per dollar of output has fallen by about 15 percent in British Columbia. (Slide 7).

The largest improvements were in residential and commercial use from better building design, higher efficiency furnaces, and government insulation rebate programs which accounted for much of the gain.

Transportation energy efficiency also improved, although in recent years some ground has been lost, owing largely to lower oil prices. Industrial energy efficiency declined somewhat overall, despite the fact that certain industries made marked improvements. (Slide 8).

There's also a considerable potential to make further improvements in energy use in all sectors of the economy. Ultimately, the best efficiency improvements are those the consumers make on their own initiative, and price is one of the best signals that alters human behaviour. Government initiatives to encourage improved energy efficiency will be noted by Warren Bell in a few moments.

But don't underestimate the role of price: today, for example, a new forest products plant can buy from B.C. Hydro at three cents a kilowatt-hour, although it might cost Hydro four cents a kilowatt-hour for new generation. Across town, or down the highway, there might be wood waste burners incinerating enough hog fuel to power that forest products plant, but energy from a waste co-generation plant would cost four and a half cents, so it probably wouldn't get built.

I'd also like to note that the Energy Ministry and B.C. Hydro have joined with the Association for Promotion and Advancement of Science Education to develop an energy education program aimed at the provincial elementary school children. The program is designed as a hands-on, participatory approach to teach children about energy and the relationship between energy use and the environment.

Clean Energy.

The pollsters tell us that environmental issues remain high on the public agenda, despite the recession. (Slide 9). I'm sure you're all generally aware of the environmental problems associated with energy. NO_x and SO_x produce acid rain, CO_2 and methane contribute to global warming. The presence of low-level ozone causes breathing problems. The absence of high–level ozone contributes to skin cancer.

British Columbia is in the favourable posi-

tion of having an abundance of renewable sources of energy. About forty percent of our energy needs are met by renewable resources, thanks to our hydro-based electricity system and bio-mass resources. This is more than twice the national average.

Energy resources must be developed and consumed in a way that minimizes, and where possible, avoids permanent environmental damage. I've already noted that the best way to reduce energy impacts on the environment, is to improve the efficiency of energy supply and use: an old kilowatt-hour that you can save is a new kilowatt-hour you don't have to generate.

Further opportunities include:
- ensuring energy prices cover full environmental costs,
- ensuring appropriate emission and effluent standards for projects are set and enforced,
- promoting, demonstrating, and commercializing cleaner energy technologies.

For example, one of the things we want to do to improve air quality in sawmill towns is turn the wood waste problem into an energy opportunity. Hydro may offer an environmental premium to the price offered for electricity purchased from private power facilities that ease a local environmental problem.

The Province's Energy Project Review Process, which for ten years, has integrated economic and environmental assessments with public consultation, is being refined and improved. The process, for example, now covers projects like wood waste and small hydro. Private thermal power projects will also be subject to the review process, and the latter will be required to meet best available technology standards for controlling plant emissions. For every new energy facility, siting and project approval will depend on the capacity of the local environment to tolerate further environmental impacts.

With funding assistance that was first promised under the National Energy Program, Pacific Coast Energy Corporation is a few months away from completing the Vancouver Island natural gas pipeline. Consumers are also being assisted to convert the fuel oil to cleaner burning natural gas in furnaces and industrial processes.

Given that most man-made CO_2 emissions are energy-related, (Slide 10), the Ministry completed an inventory to quantify man-made carbon dioxide emissions in B.C. (Slide 11). This inventory, which was conducted in conjunction with the National Task Force on Energy and the Environment, provides the basis for a provincial CO_2 reduction strategy which is being developed in consultation with the public, industry, and other government agencies. This strategy will emphasize efficiency in energy and other resource use, as well as switching to cleaner fuels.

The best hydrocarbon fuel to use from a CO_2 emissions perspective is probably natural gas.

But nothing is as simple as it seems. Before you go out to convert your car to natural gas, don't forget that methane is also a greenhouse gas that, on a CO_2 equivalent basis, is many times more potent. So a CNG-fuelled car may produce more greenhouse gas emissions than a gasoline one because of unburned methane tailpipe emissions. So if you really want to avoid contributing to global warming, use your bike or drive an electric car that is recharged using a non-fossil fuelled source.

Secure Energy

A stable and diverse supply of energy is critical to the functioning of any dynamic modern economy. B.C.'s reserves of water power, natural gas, coal and wood wastes are substantial. (Slide 12). However, the province imports 90 percent of its crude oil requirements, principally from Alberta. Since provincial oil reserves are declining, we will have to rely increasingly on out of province supplies to meet our petroleum needs in future.

Industrial and municipal wastes, essentially 'renewable' in nature, are a large potential source of new energy. Non-conventional forms, solar, wind, geothermal and tidal power, are less cost-effective, but could become more important in the future, particularly in remote and off-grid locations.

The province will maintain and improve its regulatory procedures for the review of domestic and export supplies, while maintaining an attractive investment climate: something that the National Energy Program failed to do.

Residential, commercial, and small indus-

trial users of natural gas are guaranteed secure supplies at reasonable prices by our 'core market' policy. The requirements for issuing energy removal certificates will continue to ensure that exports consist only of electricity and natural gas, which is not needed in the province.

Now, as John Allan noted at lunch today, the government supports electricity exports as long as the benefits of the exports exceed all costs, including environmental costs, by a significant margin. The private sector will be the risk taker in building any projects that serve the firm export market. B.C. Hydro will be fully compensated for any services it provides, such as wheeling and shaping.

Both the projects and export applications will be subject to the aforementioned provincial regulatory scrutiny, including public hearings in the affected region to gauge the level of community support or opposition.

Co-generation of electric power and usable heat by industries and institutions will continue to be encouraged. Self-generation and load displacement helps to diversify the province's power supply and defers the need for large new generating stations and long distance transmission. For the same reasons, B.C. Hydro is also coordinating its power systems with those of neighbouring jurisdictions.

Starting in 1998, power from the Columbia River, previously sold under long-term contracts in the United States, will be repatriated. Again, as John noted at lunch, this 'new' source of electricity, which takes advantage of existing generation facilities in the States, is essentially free, environmentally and economically. Assuming B.C. Hydro had to build facilities to produce this power, the Downstream Benefits are worth at least $250 million per year, in today's dollars, by the year 2003.

Energy for the Economy

Access to abundant low-cost energy (Slide 13) has historically been a factor in attracting energy intensive resource-based industries, such as mining, smelting, and pulp and paper. (Slide 14). Accordingly, energy development contributes to employment not only in the energy sector itself, but also much more substantially in industry. Don't forget, it was B.C. Hydro's Columbia and Peace River projects that powered the forest-based economic expansions in the Interior in the 1960s, and the 1970s,

In 1990, the value of energy sales totalled over $7.5 billion, while government revenues from energy totalled about $1.2 billion. (Slide 15). Direct energy exports amounted to over $1.9 billion; however, the energy embodied in energy-intensive goods accounted for many times this amount.

The Province's system of energy royalties, rentals, and taxes, will be monitored to see that British Columbians continue to receive their fair share of revenues as owners of the resources. For example, B.C. Hydro now pays a provincial dividend to reflect the investments made by the people of the province in B.C. Hydro.

Through policies such as de-regulation and electricity rate setting and restructuring, the B. C. Utilities Commission, the Province, and B.C. Hydro continue to ensure that energy is priced competitively and fairly. While B.C. Hydro's rates will increase gradually to encourage more efficient use, the impacts on consumers and industrial competitiveness must also be recognized. You may recall the earlier slide of energy use per capita. Not surprisingly, those countries with the highest prices use the least energy.

Recently, there has been interest in a greater role for the province's private sector in B.C.'s electricity industry. B.C. Hydro is looking to private power purchases as one of its key resource options for the 1990s, and beyond. On the customer's side of the meter, energy service contractors will be implementing low and high technology, and 'smart house' technology ways to dampen consumer demand and reduce electricity bills.

Beyond the 1990s

What about the future beyond the 1990s, (Slide 16). There are several good examples of sustainable energy decision-making in B.C., where the environment has really come out unscathed or ahead. This includes the Skagit Treaty, the Kootenay Canal Plant Agreement, the Williams Lake wood waste-fuelled generating station, the return of the Downstream Benefits, coordination benefits from the Kemano Completion Project, Dr. Ballard's fuel cell, our appliance efficiency standards and our proposed energy code.

But we still have a ways to go before we have

a truly sustainable energy future. The National Energy Board, for example, predicts growth in energy demand in Canada of 30 to 40 percent in the next 20 years, with the fastest increase being shown in oil, gas, and coal.

Our B.C. forecast shows demand increasing by about 31 percent over the next 20 years, and depending on the fuels used, about a 20 to 25 percent increase in energy related CO_2 emissions.

Underscoring these analyses is the premise that our energy affairs will be conducted in the future as they were in the past. This is a premise that is increasingly questionable.

Basic utility policies and priorities are being changed by conservation, end-use efficiency, and demand side management.

Revolutionary changes in energy applications will challenge utilities and governments. For example, as Mr. Morgan noted, General Motors will be selling a new electric car, appropriately called the Impact, and we read that it will be sold at a price of about $20,000, and will be available in about a year's time, in 1992.

In California, Pacific Gas and Electric says it wants to double its Canadian gas purchases so it can meet demand for natural gas-fuelled vehicles. Monopolies are in decline: new suppliers and service companies will force utilities to compete on price, quality, and types of services. In Ontario, for example, Energy Probe wants to break up Ontario Hydro, with only the distribution system remaining as a government-owned monopoly.

There will be technological breakthroughs: Geoff Ballard's fuel cell was chosen recently by both GM and the US Department of Energy as the fuel cell of choice for automotive applications. Earlier this month, Southern California Edison announced its silicon technology will halve the cost of solar-voltaic produced electricity to around 14 cents a kilowatt–hour. That still sounds expensive, but who knows?

Policy/Regulatory Issues

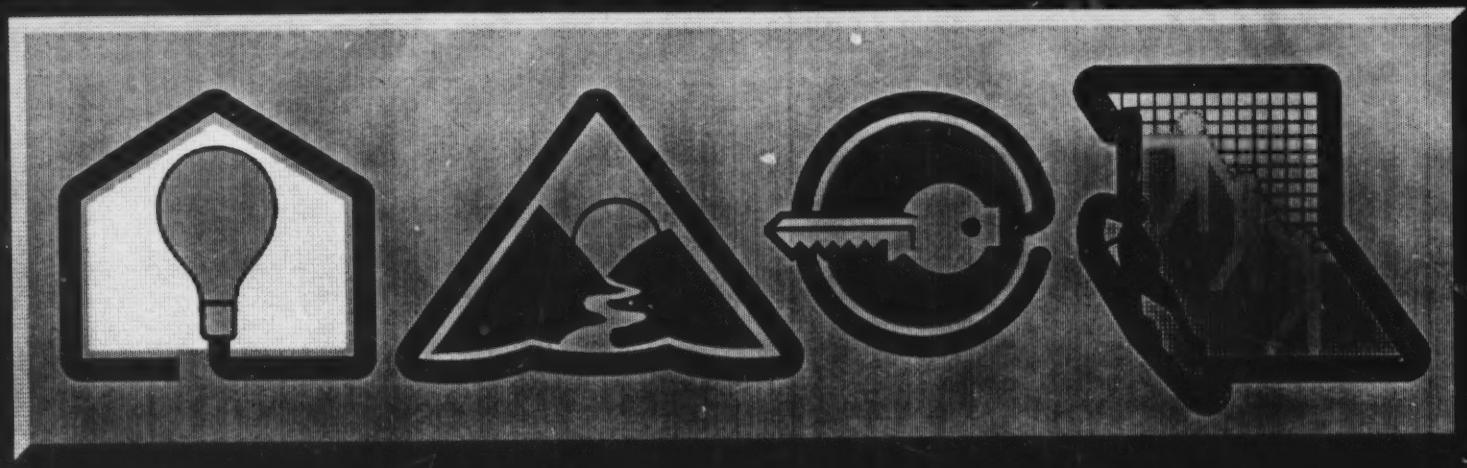
- Will the policy and regulatory people keep up, or is 'institutional lag' inevitable? (Slide 17).
- The traditional command and control model of regulation will disappear. Already, we must work with an alphabet soup of regulators: NEB, FERC, NEPA, CPUC, FEARO, DFO, DIAND, BCUC, EFSEC, any one of whom can come out of the woodwork and derail an initiative.
- Concern for the environment and demands for efficiency will continue to dominate. Different regions and utilities, acting independently, are less able to ensure that the full range of environmental preferred resource options are developed first. Collectively, we can make optimum use of existing and new resources by preserving interdependence: this involves services unbundling, wheeling, and a pool operation to buy, sell, and store electricity.
- Pacific Northwest Utilities could, for example, replace some of the foregone Downstream Benefits by buying conservation or system efficiency improvements in western Canada, maybe Alberta, who knows?
- Finally, the public will demand a greater say in energy decisions: recall the recent vote in Vermont on whether their utilities should buy electricity from Hydro Quebec's James Bay project.
- So, by developing projects that cut waste, pricing energy realistically, encouraging efficiency, reducing oil consumption and promoting new sustainable supplies, in B.C. we should probably be ready for these changes.

Thanks very much.

Einar Field: Before we have the question period on Peter Ostergaard's speech on Provincial Policy, perhaps we could continue with the next speaker, Warren Bell, who will also be addressing the importance of government policies, but in this particular case, focusing on Energy Efficiency in British Columbia.

Energy Policy in British Columbia

New Directions for the 1990's



Ministry of Energy, Mines and Petroleum Resources

Slide 1

The National Energy Program (1980)

Objectives

1. SECURITY of supply and ultimate energy independence

2. OPPORTUNITY for Canadians to participate in energy industries, especially oil and gas

3. FAIRNESS in pricing and the sharing of revenues among governments and industry

Source: "The National Energy Program Highlights, 1980"

Slide 2

British Columbia Energy Policy (1990)

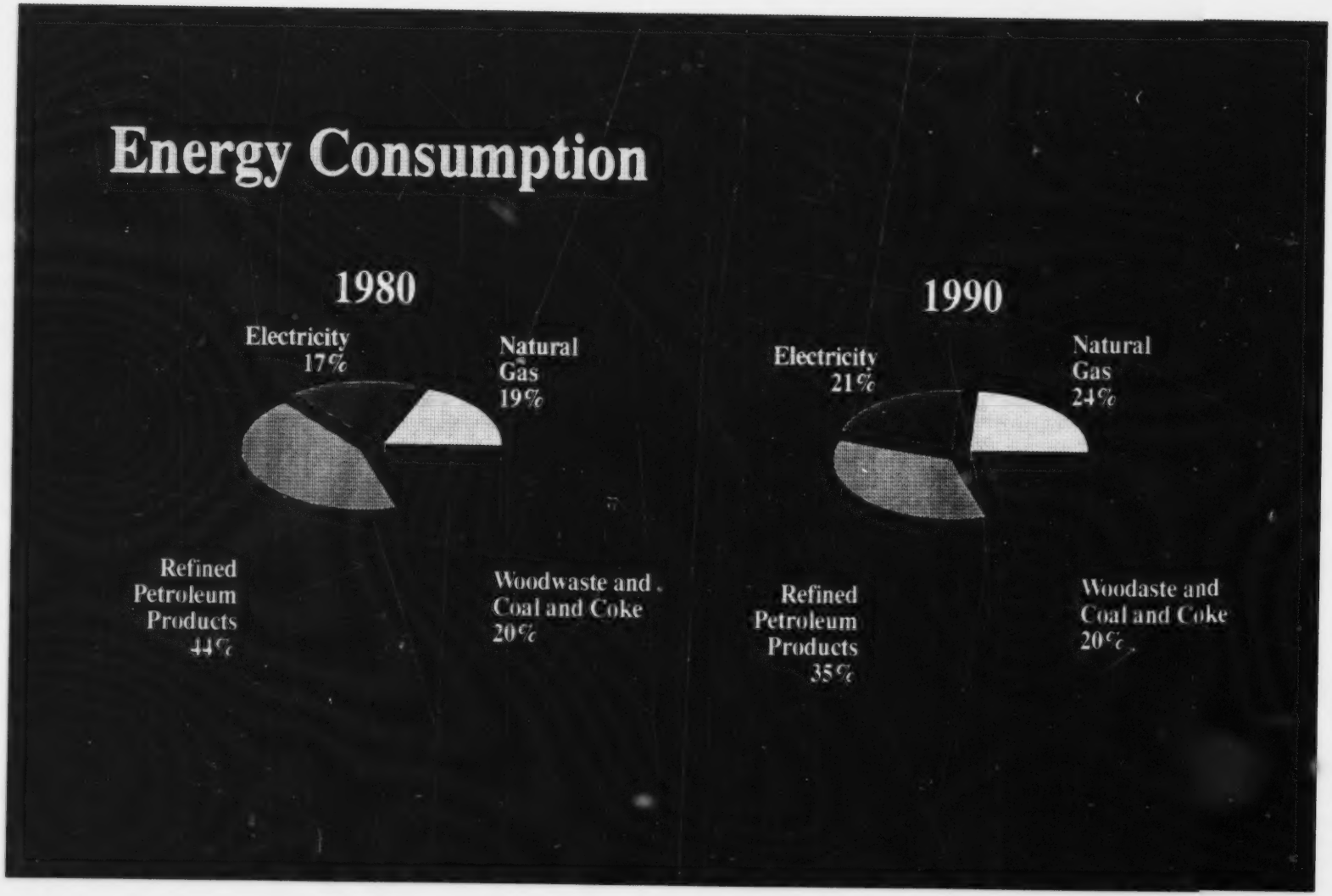
ENERGY EFFICIENCY
Cut waste to lower energy bills and benefit the environment

CLEAN ENERGY
Shift to cleaner sources to reduce impacts and improve environmental quality

SECURE ENERGY
Manage existing resources, find new ones and increase choice to ensure security

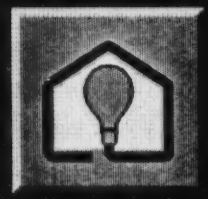
ENERGY FOR THE ECONOMY
Keep prices reasonable and develop energy resources to stimulate regional development

Slide 3


Energy Consumption
1980
Electricity
17%
Natural
Gas
19%
Refined
Petroleum
Products
44%
Woodwaste and
Coal and Coke
20%
1990
Electricity
21%
Natural
Gas
24%
Refined
Petroleum
Products
35%
Woodaste and
Coal and Coke
20%

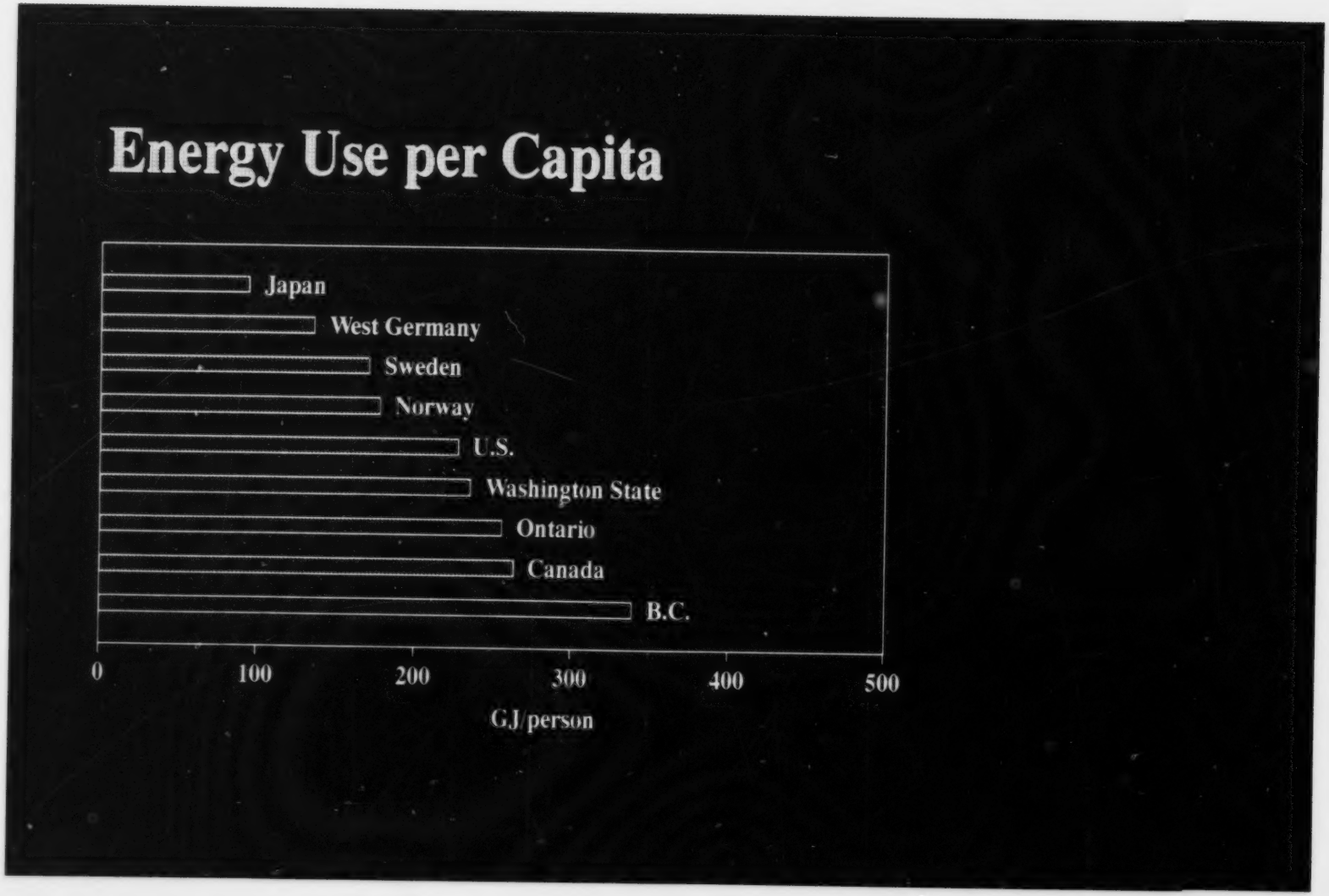
Slide 4

Efficient Energy



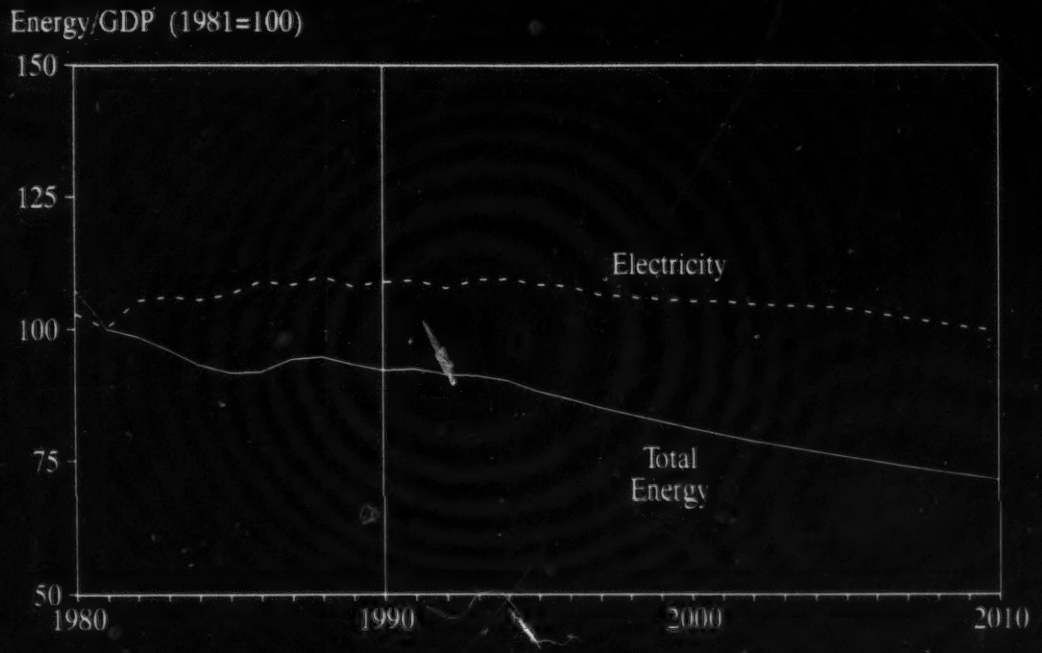
- Energy Intensity
- Energy Pricing
- Energy Education

Slide 5

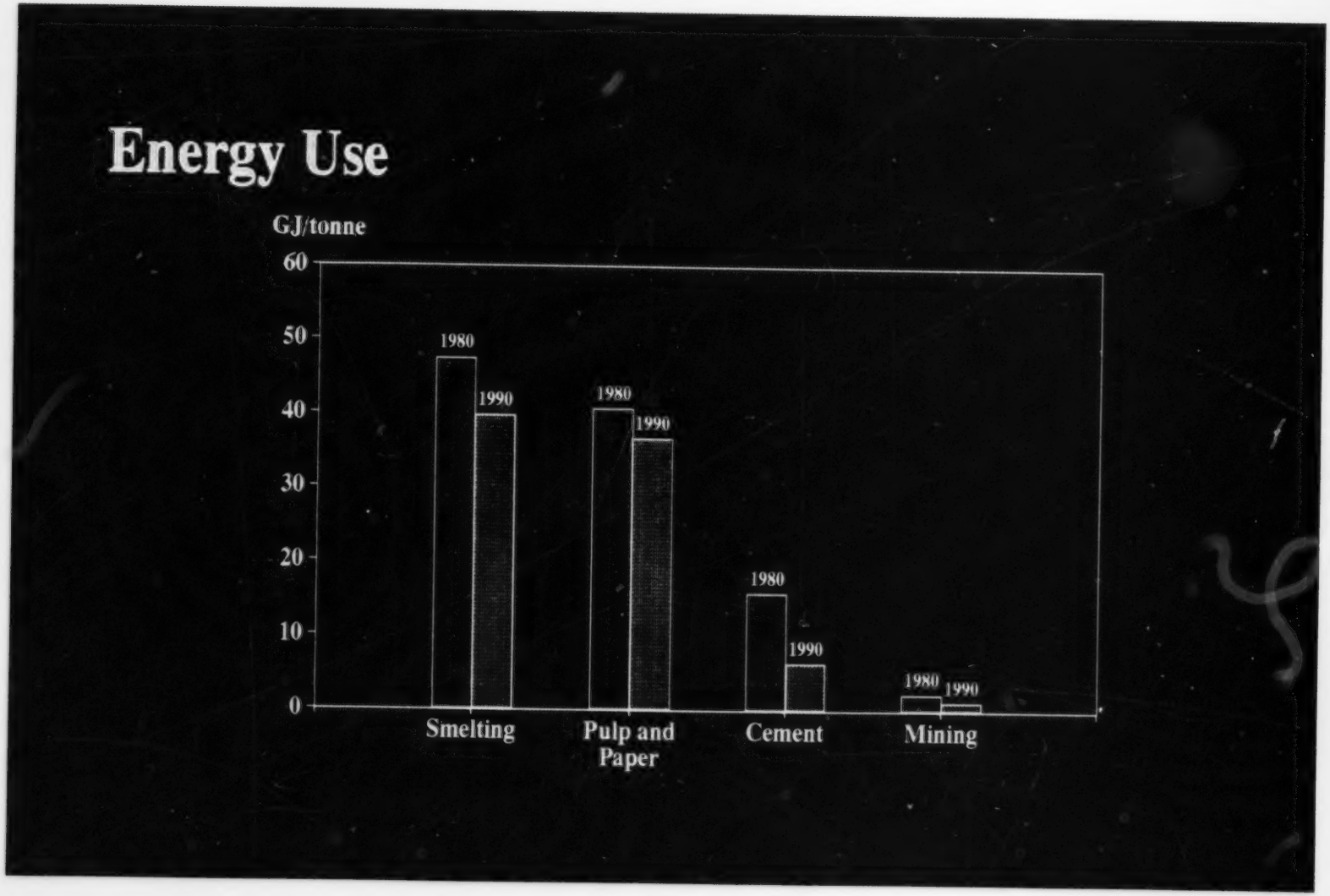

Energy Use per Capita
Japan
West Germany
Sweden
Norway
U.S.
Washington State
Ontario
Canada
B.C.
0
100
200
300
400
500
GJ/person

Slide 6

Energy Intensity



Slide 7

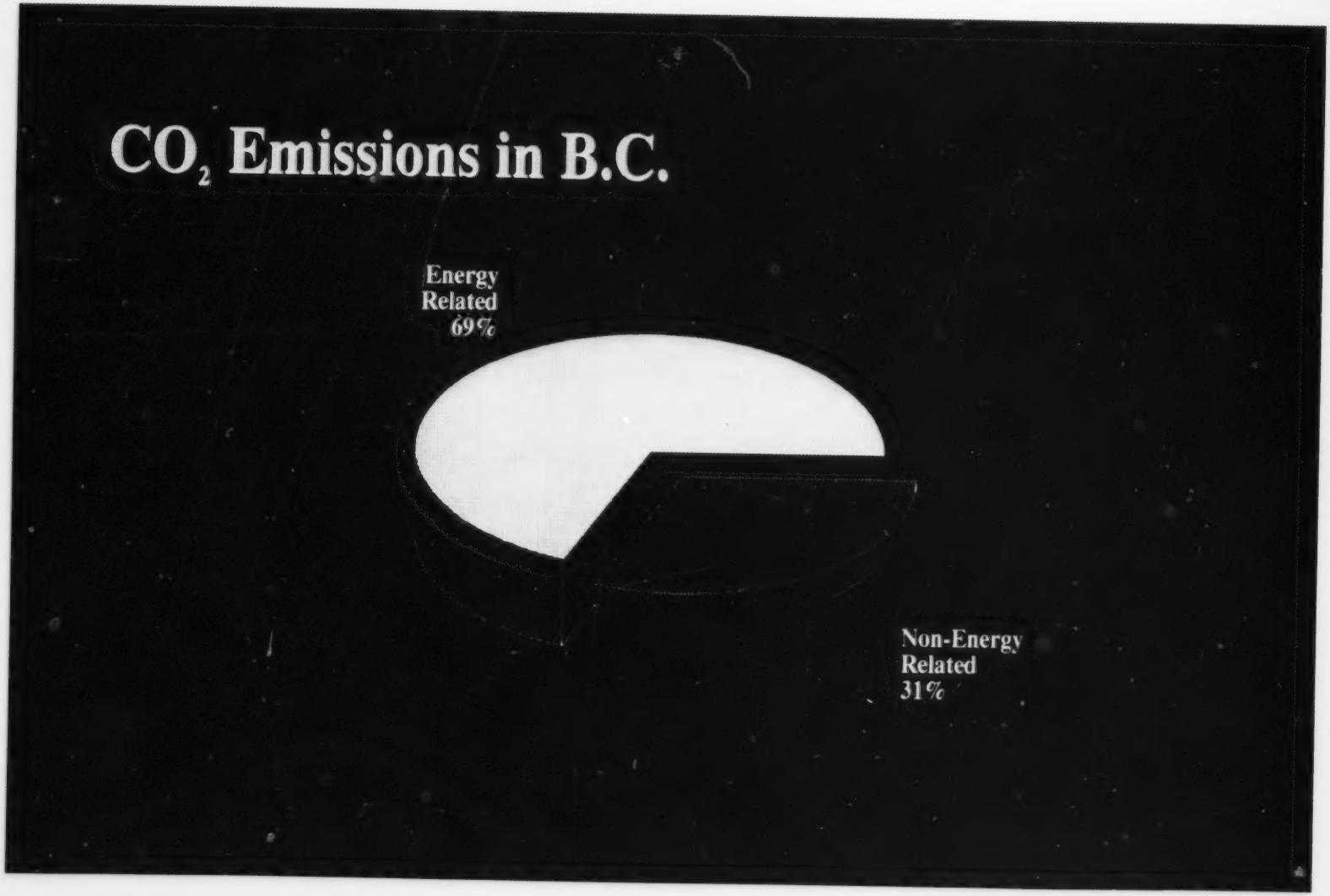

Energy Use
GJ/tonne
60
50
40
30
20
10
0
1980
1990
1980
1990
1980
1990
1980
1990
Smelting
Pulp and Paper
Cement
Mining

Slide 8

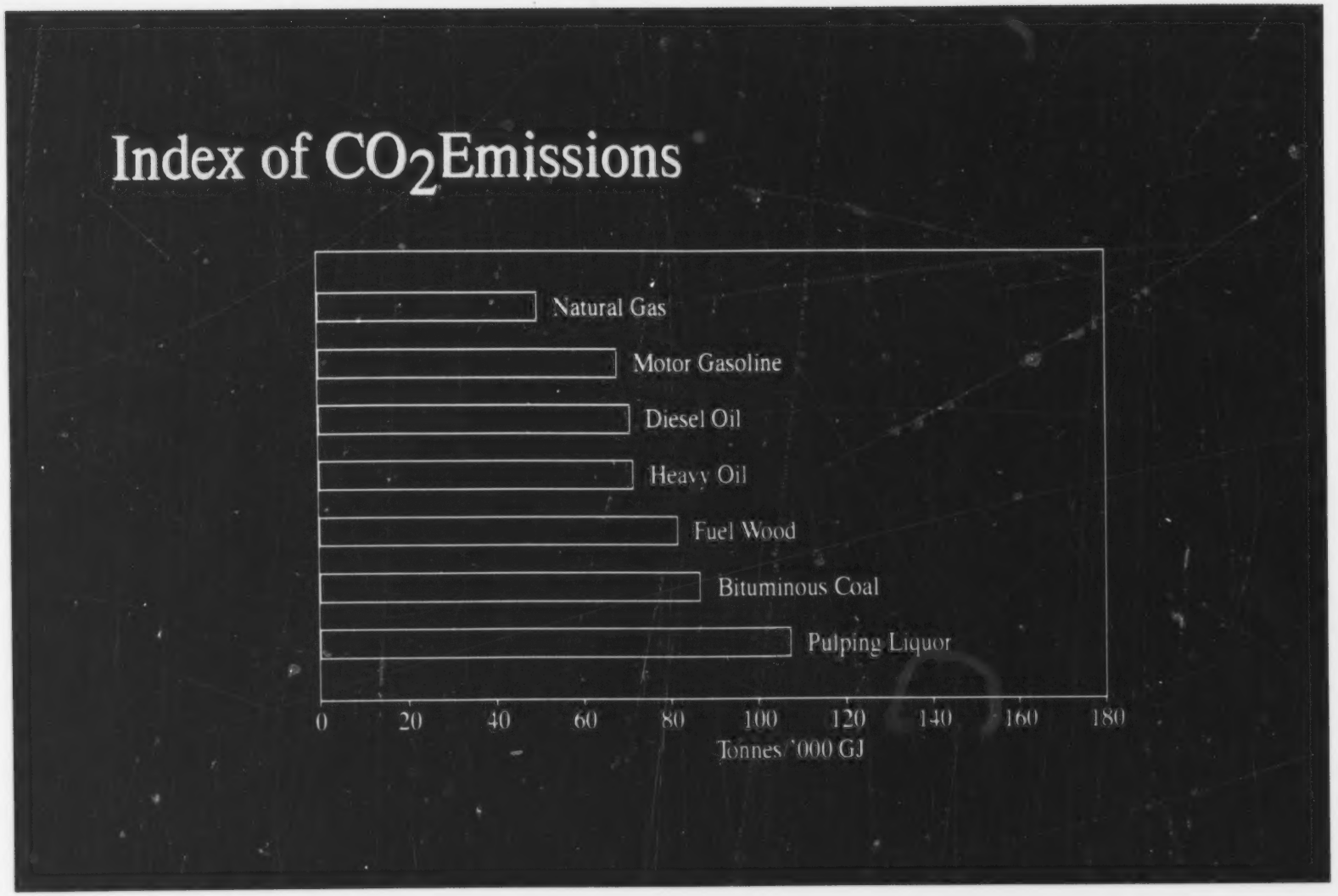
Clean Energy

- Environment and Land Use
- Vancouver Island Natural Gas Pipeline
- Air Quality
- Energy Project Review Process

Slide 9



Slide 10


Index of CO_2 Emissions
Natural Gas
Motor Gasoline
Diesel Oil
Heavy Oil
Fuel Wood
Bituminous Coal
Pulping Liquor
0
20
40
60
80
100
120
140
160
180
Tonnes '000 GJ

Slide 11

Secure Energy

- Off oil and oil efficiency programs
- New Sources (Conventional and Non-Conventional)
- Energy Removals
- Cogeneration

Slide 12

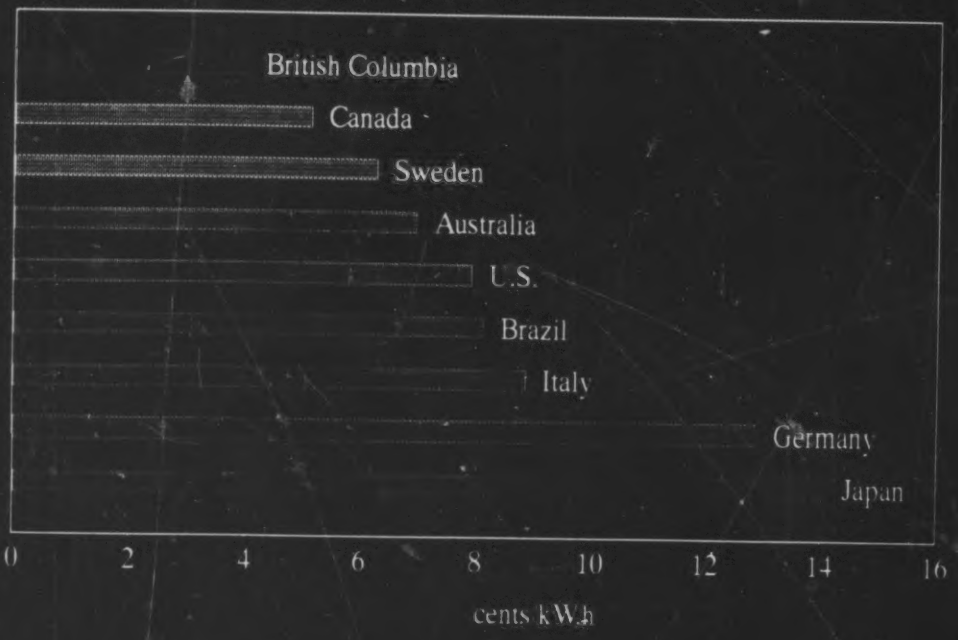
Energy for the Economy

- Sales
- Provincial Revenues
- Independent Power Producers
- Energy Service Companies

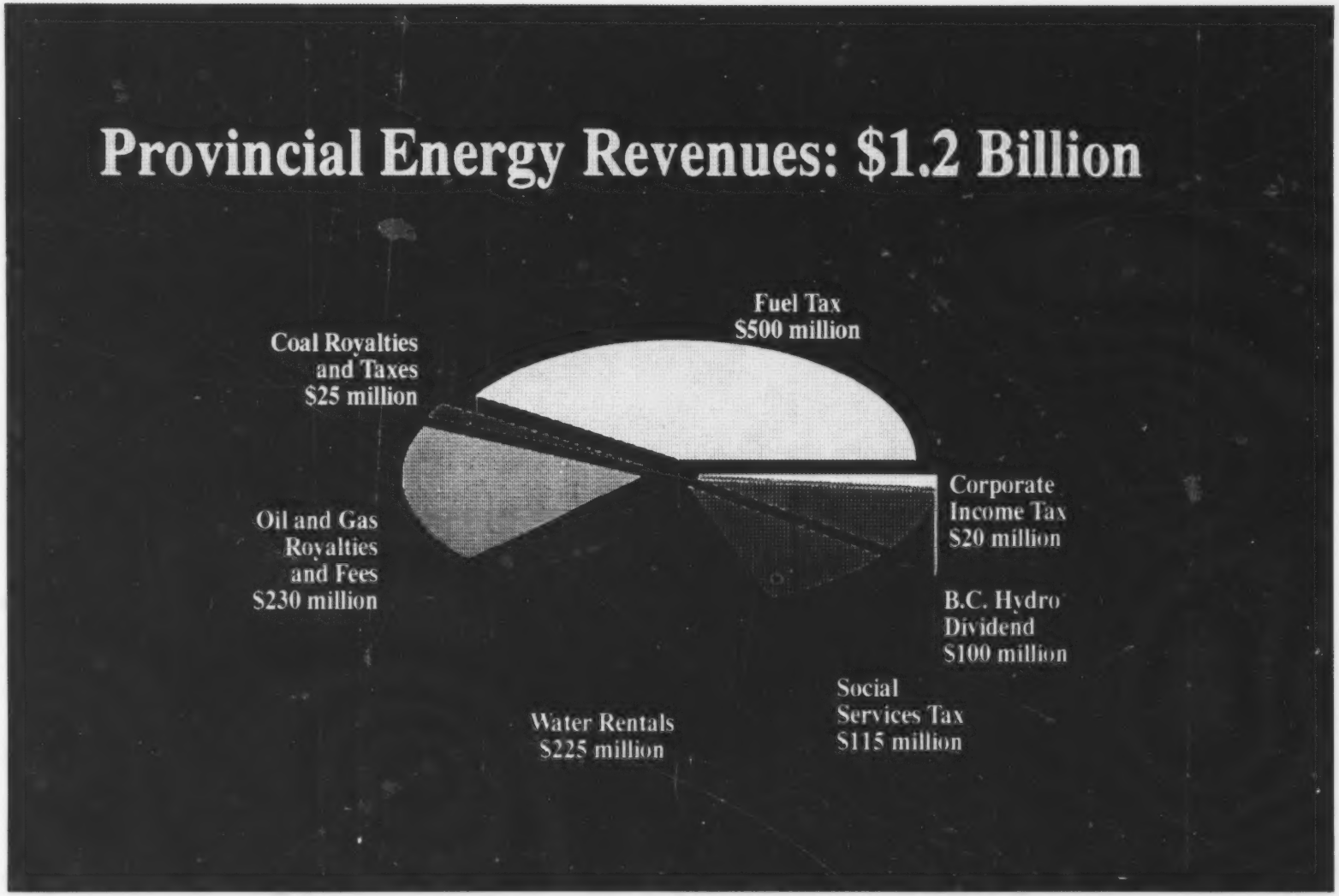
Slide 13

Energy for the Economy

Light Industrial Electricity Prices



Slide 14


Provincial Energy Revenues: $1.2 Billion
Fuel Tax
$500 million
Coal Royalties
and Taxes
$25 million
Corporate
Income Tax
$20 million
Oil and Gas
Royalties
and Fees
$230 million
B.C. Hydro
Dividend
$100 million
Social
Services Tax
$115 million
Water Rentals
$225 million

Slide 15

Beyond the 1990s

DEMAND BEFORE SUPPLY
Conservation, end-use efficiency and demand management

NEW MARKETS
Mass production of electric and CNG vehicles

NEW PLAYERS
Competition based on service and price

NEW TECHNOLOGY
Fuel cells and photovoltaics

Slide 16

Emerging Policy/Regulatory Issues

- Challenges to Traditional Regulatory Authorities
- Obligation to Optimize Generation and Transmission Systems
- Unbundling in Electricity
- Decisions Driven by Environment and Regional Consensus
- Heightened Public Awareness

Slide 17

Government Policy on Energy Efficiency

Warren Bell

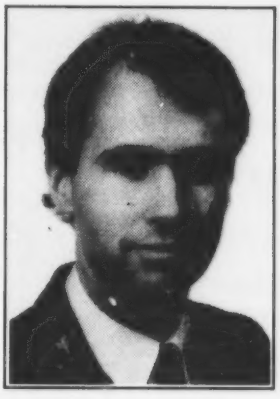
Director, Energy Management Branch, Ministry of Energy, Mines and Petroleum Resources

Introduction of Warren Bell by Einar Field

Warren Bell joined the Ministry of Energy, Mines, and Petroleum Resources in 1986, after earning degrees in economics from the University of Victoria and the University of Western Ontario. He's currently the Director of Energy Management with responsibility for energy efficiency policy, programs and legislation, energy forecasts, and economic and statistical analysis.

Please welcome Mr. Warren Bell.

Government Policy on Energy Efficiency



Thank you very much, and thank you for sticking with us through a very long agenda, especially on a day like this. My main duty as last speaker is to be reasonably brief, and I trust you'll hold me to that. If we could have the first slide and the lights down, please. (Slide 1)

I was always taught that there was no such thing as a free lunch. However, if there is one, it's energy efficiency:

- Energy efficiency reduces pollution and other environmental impacts.
- Energy efficiency is the least-cost new resource for utilities. Not only do they use less energy, but if energy efficiency is their least-cost new resource, that means that utility rates are kept down.
- Energy efficiency saves money for consumers, for two reasons:
  (1) Consumers use less energy.
  (2) Lower utility costs mean lower rates.

As well, lower costs for business also means being more competitive in an increasingly competitive world.

As Amory Lovins once said, "Energy efficiency isn't just a free lunch, it's a lunch you get paid to eat."

The challenge of achieving a cleaner, more energy-efficient world has been laid out for us by Frank King. What, then, is the government's role?

The Role of Government

I'd like to talk a little bit about the government's role in promoting energy efficiency. (Slide 2)

B.C. Hydro and others have made some very impressive strides in promoting a 'conservation ethic.' Government also has a role to play in promoting energy efficiency:

- Government can legislate minimum standards to keep energy-wasting equipment out of the market place.
- Government can help raise awareness through information and education.
- Government can sponsor research, development, and demonstrations to bring new technology to market.
- Government can ensure that energy prices send the right signals to consumers.

Today, I'd like to talk about the first two roles of government, government as regulator and government as facilitator and educator.

The Role of Regulation

As a regulator, government can set minimum energy performance standards. (Slide 3) In British Columbia, we are setting minimum standards for buildings.

Regulated minimum standards offer a number of advantages: the most basic and impor-

tant is protection for consumers. Consumers often don't have the information on energy efficient products they'd like to have, or perhaps more importantly, they don't have the time to use it.

For example, you wake up one morning and your basement is full of water, your hot water tank has sprung a leak. You'd probably like to buy an energy-efficient hot water tank. You've read all the material, you've seen the Power Smart promotions, you'd like to do the right thing, but what really matters is that your family is really annoyed and they want their hot water back. So nine times out of ten what you're going to do is buy the hot water tank that can be delivered and installed the fastest for the least money, and maybe if you feel really guilty, you'll send in a donation to Greenpeace.

Other consumers never get a chance to make that choice. Renters, for example, have no say in the choice of appliances they use, never mind the amount of insulation in the walls, yet they're the ones who pay the energy bills and are often those in society least able to afford high energy costs.

So, regulations protect consumers by keeping energy wasting equipment off the market.

Regulations also provide a level playing field for industry. Everyone plays by the same rules. Manufacturers of efficient refrigerators shouldn't have to lose market share to competitors who sacrifice efficient compressors and better insulation in order to offer the lowest price.

Regulations also provide support for utility programs like Power Smart. Legislated minimum standards and utility rebate programs work together. Minimum standards eliminate the energy guzzlers, while programs like Power Smart encourage customers and consumers to buy the most energy-efficient products available. Over time, as technology improves and markets change, the minimum standards and the rebates can be coordinated to move up the energy efficiency scale together.

This coordination has happened or is about to happen in British Columbia. On May 1st, the first regulation under the Energy Efficiency Act comes into effect that will regulate hot water tanks. At the same time, Hydro is phasing out its hot water tank program and devoting its resources to other more promising programs.

Regulations also provide very low-cost energy savings. There are no rebates, there are no expensive promotions, administration costs are low, and you get 100 percent saturation of the market.

And finally, regulations provide a standard for measurement of our progress towards an energy efficient economy and send a clear signal to consumers and to industry that energy efficiency really matters.

The Energy Efficiency Act

The first energy efficiency initiative introduced in British Columbia was minimum standards for equipment. (Slide 4) The Energy Efficiency Act was passed by the B.C. legislature last August without a dissenting vote.

This Act allows government to set minimum performance standards for appliances, lighting, motors and other energy-using equipment. Equipment regulated under the Act must meet minimum performance standards before it can be sold in British Columbia. As well, the equipment has to be labelled to show that it meets the standard, in the same way that other products are labelled to show they meet safety standards.

Equipment efficiency standards are relatively new, well, certainly new to British Columbia, but also relatively new to North America. B.C. is only the second province to have legislated efficiency standards. Ontario was the first, in 1989. The way, of course, was led by California, which introduced minimum efficiency standards for equipment in 1985.

Energy Efficiency Standards Regulation

Beginning May 1, a wide range of household appliances, from refrigerators and ranges to furnaces and hot water tanks, will have to meet minimum performance standards before they can be sold in British Columbia. (Slide 5)

These standards are the same as those introduced in Ontario. These standards were developed primarily by the Canadian Standards Association, in consultation with industry, utilities, government, and consumer groups.

Almost every major household appliance is covered by this list, but it's only a start. Industry has been put on notice that we will soon be expanding the list and revising the standards to

introduce tougher requirements.

Efficiency Standards: The Next Steps

The next major step is to expand the list of appliances and equipment coverage to include the industrial and commercial sectors. (Slide 6) In these areas, our two key targets are lighting and motors: lighting accounts for 40 percent of electricity demand in the commercial sector, and motors account for 90 percent of electricity demand in the industrial sector.

Sometime this year, we expect to have minimum standards in place for electric motors and fluorescent lamp ballasts. British Columbia will likely be the first jurisdiction in North America with legislated minimum efficiency standards for motors. Motors are particularly important, because they account for 90 percent of industrial electricity demand, and 40 percent of total electricity consumption in B.C.

Motors have significant conservation potential. Minimum standards for motors alone could save 200 gigawatt-hours of electricity per year by the year 2005; enough electricity to meet the needs of a town of 30,000 people.

We will also be reviewing standards to upgrade them regularly. By January of next year, we expect to have tougher standards in place for gas furnaces. We're also planning to introduce much tougher standards for refrigerators.

Eliminating Energy Guzzlers

Next to your furnace and your hot water tank, your refrigerator is the largest single energy user in your home. (Slide 7) Refrigerators are also an excellent example of the kind of energy conservation savings that can be gained without any loss of performance.

The refrigerator in the average B.C. home uses between 1400 and 1500 kilowatt-hours of electricity per year. By 1994, the only refrigerators that will be allowed to be sold in British Columbia will use less than half of that. This will require a dramatic change in refrigerator manufacturing - less than five per cent of the models on the market today can meet the proposed 1994 standards.

Building Codes

Another important area where minimum standards can play a role is buildings. (Slide 8) Buildings are a particularly important source of energy savings for tomorrow. Because buildings last for 70 years or more, energy efficiency investments made or not made have implications far into the future. And since retrofitting houses for energy efficiency can be very expensive, inefficient construction is a lost opportunity. The key is to build efficiency in at the start.

There are currently no minimum energy standards in the B.C. Building Code. However, the Ministry and B.C. Hydro have proposed that minimum energy standards be included in the 1992 Building Code. The Building Code is currently being revised. I should point out that ours is one of a number of proposed amendments to the Code and success is not guaranteed. The process of Code revision is public. Public meetings will be held during the spring and summer of this year and the final Code will be put in place sometime next year, perhaps as soon as January.

Proposed Building Standards

For the residential sector, the Ministry and B.C. Hydro developed the proposed minimum standards together. (Slide 9)

It's important that minimum standards be fairly straightforward to implement and enforce, particularly in the residential sector. If the requirements are too complex, then builders may not adhere to the requirements and they may be difficult to enforce as well. As a result, we have proposed simple prescriptive requirements that specify minimum levels of thermal insulation for the walls, ceilings, windows and floors. For example, R20 in the walls and R28 in the attic.

The standards also had to be cost-effective. That meant that the cost of the extra insulation had to be more than offset by the value of the energy saved over time.

Because of the criteria of cost-effectiveness, the standards are sensitive to climate and fuel type. In colder regions of the province, the potential for energy savings is greater. Consequently, more insulation would be required in the colder areas of the province. Similarly, since electricity is considerably more expensive than natural gas, the value of energy saved from electrically-heated homes is greater. Thus, electrically-heated homes would be required to have higher levels of insulation than homes heated by natural gas.

For larger commercial buildings, we're pro-

posing that British Columbia adopt what's known as ASHRAE/IES 90.1, which is an American standard. This is the most comprehensive and up-to-date energy standard for large commercial buildings, and this standard, or earlier versions of it, are in wide use in the United States. B.C. would be the first province to adopt this kind of standard for large buildings.

Like the Residential Code, the Commercial Code has a prescriptive option. It also has what's called a performance option. That means that an energy budget is set for the building and the architect and the engineer then have some freedom to design the building however they like, as long as it meets the overall energy budget.

The Code has important implications for air quality as well. At present there are no specific standards for indoor air quality in commercial buildings beyond the industrial guidelines contained in Workman's Compensation Board Regulations. ASHRAE 90.1 requires that buildings meet ventilation standards, and therefore will ensure that all new buildings built to this standard will have good indoor air quality.

Regulated minimum standards for equipment and buildings are a powerful tool to achieve energy efficiency, particularly when they were combined with programs like Power Smart, that encourage consumers to buy the most energy efficient products on the market.

These standards and the utility programs they complement apply primarily to electricity and natural gas. I'd like now to turn to a different fuel, a different challenge, and a different approach.

The fuel is oil. (Slide 10) First of all, a few facts. Oil still accounts for a third of energy consumed in British Columbia. Oil consumption has declined somewhat since 1980, but I should point out that most of those gains were made during the first five years of the decade, due to high energy prices and a recession. Since 1985, oil consumption has been increasing. While cars are generally more efficient than they used to be, the trend seems to be reversing. Consumers are buying larger and more powerful cars and of course, the number of cars on the road just keeps rising.

Less than a quarter of the oil consumed in British Columbia is produced here and that proportion is expected to decline.

On the demand side, British Columbians use a wide range of oil products, but predominantly gasoline and diesel in motor vehicles. They account for more than half of oil consumption in B.C.

We've talked about some of the implications of oil use already, but let's just quickly whip through them again. (Slide 11) Land use impacts, exploration, drilling, transmission pipelines, refineries, all have major land use impacts. This is to say nothing of the impact on the highways and the parking lots for the cars that we drive.

The images of oil-soaked birds we seem to see all too regularly on the news are a vivid reminder of the impact of oil spills. Another problem perhaps almost as bad is ground water contamination from the dumping of waste oil.

The consumption of oil is a major contributor of carbon dioxide emissions and also a major source of sulphur dioxide emissions, which contribute to acid rain.

And finally, oil products used in cars are a major source of urban air pollution. Over 80 per cent of the air pollution in the Lower Mainland is contributed by motor vehicles.

The challenge to cut oil consumption and increase energy efficiency is a difficult one. Gasoline is cheap. Cars are convenient, some people would say they're indispensable.

The challenge is made more difficult by the fact that there are many players, many levels of government involved, from vehicle manufacturers, to consumers, and urban planners.

Well, what's government's role? One approach is regulation, and beginning later this year, emission testing for vehicles will become mandatory in the Lower Mainland.

The Ministry of Energy has taken a different approach, and one which I think illustrates fairly well the role of government as an educator. And here I speak of educator as a facilitator, leader, and perhaps coordinator.

Inspired by the success of Power Smart, the Ministry of Energy is putting together a series of

programs under the Fuel Smart banner. (Slide 12) The objective of Fuel Smart is to reduce oil consumption and increase energy efficiency. The benefits are obvious, from a cleaner environment to lower energy costs, enhanced energy security, and a healthier economy.

The Fuel Smart program itself has two key elements. (Slide 13) The first is a focus on achieving an ethic change. The main lesson that we've learned from Power Smart is that unless you set out to change the way people perceive and behave towards energy, all you've got is a collection of unrelated rebate programs, and I think that's what sets Power Smart apart from some of the other programs in North America that have been less successful.

I believe it's Power Smart's emphasis on creating the conservation ethic that's contributed to its success. Ethic changes created by education and by raising awareness, and Fuel Smart will target that ethic change through a combination of general public information programs and carefully targeted education programs.

The second key element is partnerships. There's very little that the Ministry of Energy, acting alone, can do to solve the oil and environment problem. By working together, however, and working with other agencies, we can have a much larger impact. Fuel Smart is developing as a program through the formation of partnerships with other government agencies, utilities and the private sector.

Although the Fuel Smart program is very developmental, we'd like to share with you several of the projects that we've started.

Slide 14, Programs With Partners, illustrates some of the programs that we've started under Fuel Smart.

Ride sharing. Ride sharing or car-pooling is one of the most immediate and effective ways to cut vehicle use. We're conducting a major pilot project with Simon Fraser University to test a computer-based ride-matching program, and as well the associated administrative and promotional aspects of ride sharing. A pilot program is planned for Victoria.

Driver training. Driver training is also very important. In partnership with Energy Mines and Resources Canada and the B.C. Safety Council, we've launched a program called 'Protrucker' that will teach fuel-efficient driving techniques to over 7,000 truckers over the next three years.

We'll also be working on a more expanded driver education program targeted to some of the fleets that operate within cities, and general driver education as well.

Vehicle management. A comprehensive fleet management program is also planned that will include things like route planning, vehicle selection and alternative fuels.

Government Leadership. There is a clear role for government leadership here, and in this regard, the government recently announced that a third of the new vehicles to be purchased this next year by the Government of British Columbia will be alternative fuel vehicles. As well, a committee of the Crown corporations in British Columbia, of which B.C. Hydro is one, is currently evaluating ways to cut emissions over the next three years by 50 per cent.

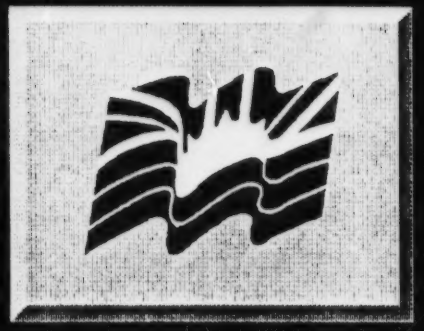
We've been very impressed so far by the level of interest expressed to us in Fuel Smart, and also very impressed by the number of things that people out there are already doing on their own. Fuel Smart is a 'bottom-up' program. If you or your organization is interested in partnering up with the British Columbia government in Fuel Smart, we'd like to hear from you.

After all, while regulations are one way to enforce energy efficiency, it's probably only by working together that we'll get where we're going or where we'd like to be.

Thank you very much.

Energy Efficiency in British Columbia

The Role of Government



Ministry of Energy, Mines and Petroleum Resources

Slide 1

Energy Efficiency

- B.C. Hydro and other utilities are actively promoting energy efficiency
- Government also has a role to play, through:
  - Regulation
  - Information and education
  - Research, development and demonstration
  - Energy pricing policy

Slide 2

The Role of Regulation

- Minimum energy performance standards for buildings and equipment
- Minimum standards result in:
  - Protection for consumers
  - A level playing field for industry
  - Support for utility DSM programs
  - Low cost energy savings

Slide 3

Energy Efficiency Act

- New legislation (August 1990)
- New equipment regulated under the Act must meet minimum energy standards to be sold in B.C.
- Equipment must be labelled to show that it complies with the Act
- The first regulation under the Act takes effect May 1, 1991

Slide 4

Energy Efficiency Standards Regulation

Beginning May 1, 1991, standards cover:

- Refrigerators
- Electric water heaters
- Gas furnaces
- Electric clothes dryers
- Gas ranges
- Heat pumps
- Oil water heaters
- Clothes washers
- Electric ranges
- Dishwashers
- Air conditioners

Slide 5

Efficiency Standards: Next Steps

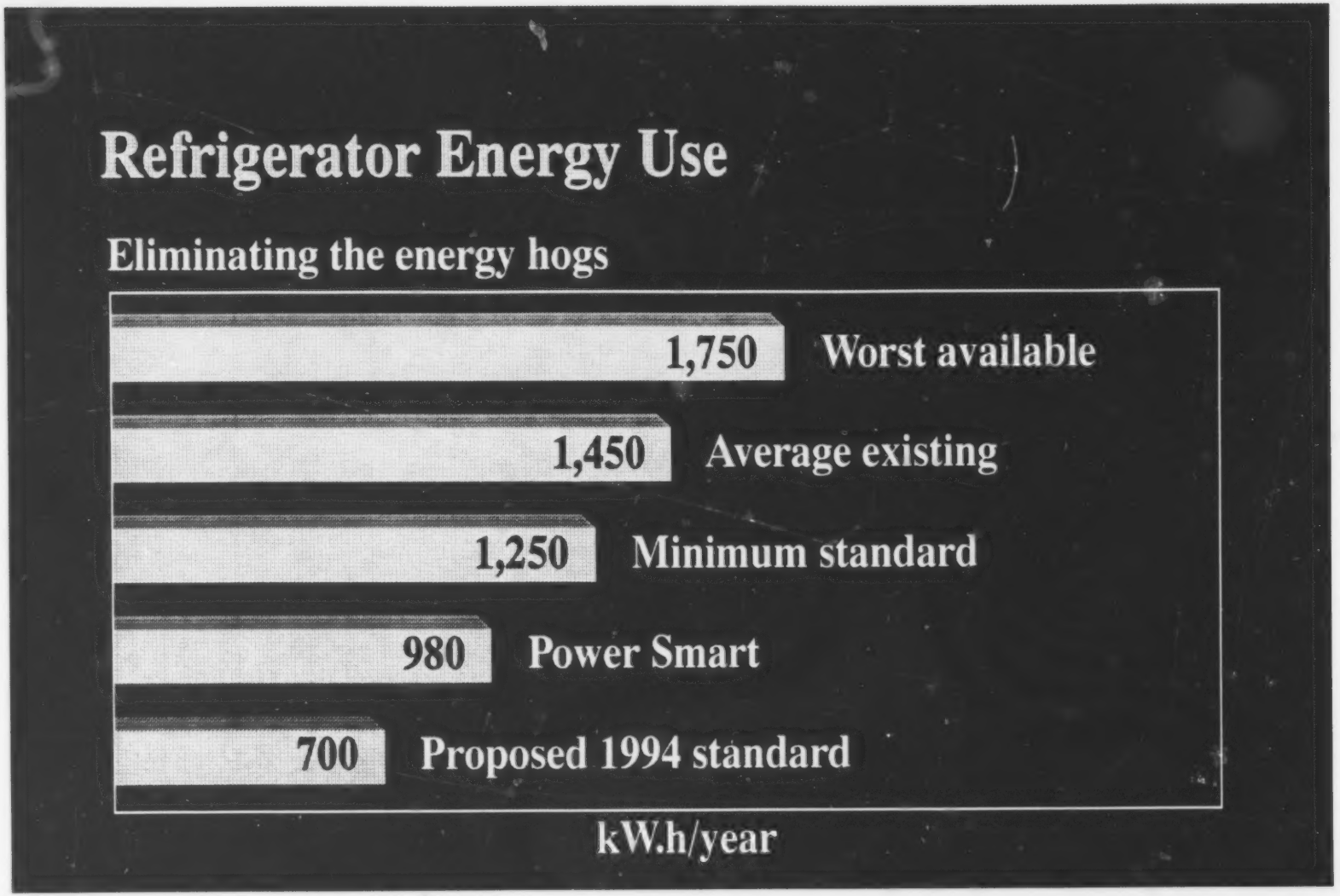
New standards for:

- Electric AC motors
- Fluorescent lamp ballasts

Upgraded standards for:

- Gas furnaces
- Refrigerators

Slide 6


Refrigerator Energy Use
Eliminating the energy hogs
1,750
Worst available
1,450
Average existing
1,250
Minimum standard
980
Power Smart
700
Proposed 1994 standard
kW.h/year

Slide 7

Building Code

- Presently no energy standards in B.C. Building Code
- Building Code is being revised for 1992
- MEMPR and B.C. Hydro have proposed ninimum energy standards for new residential and commercial buildings

Slide 8

Proposed Building Standards

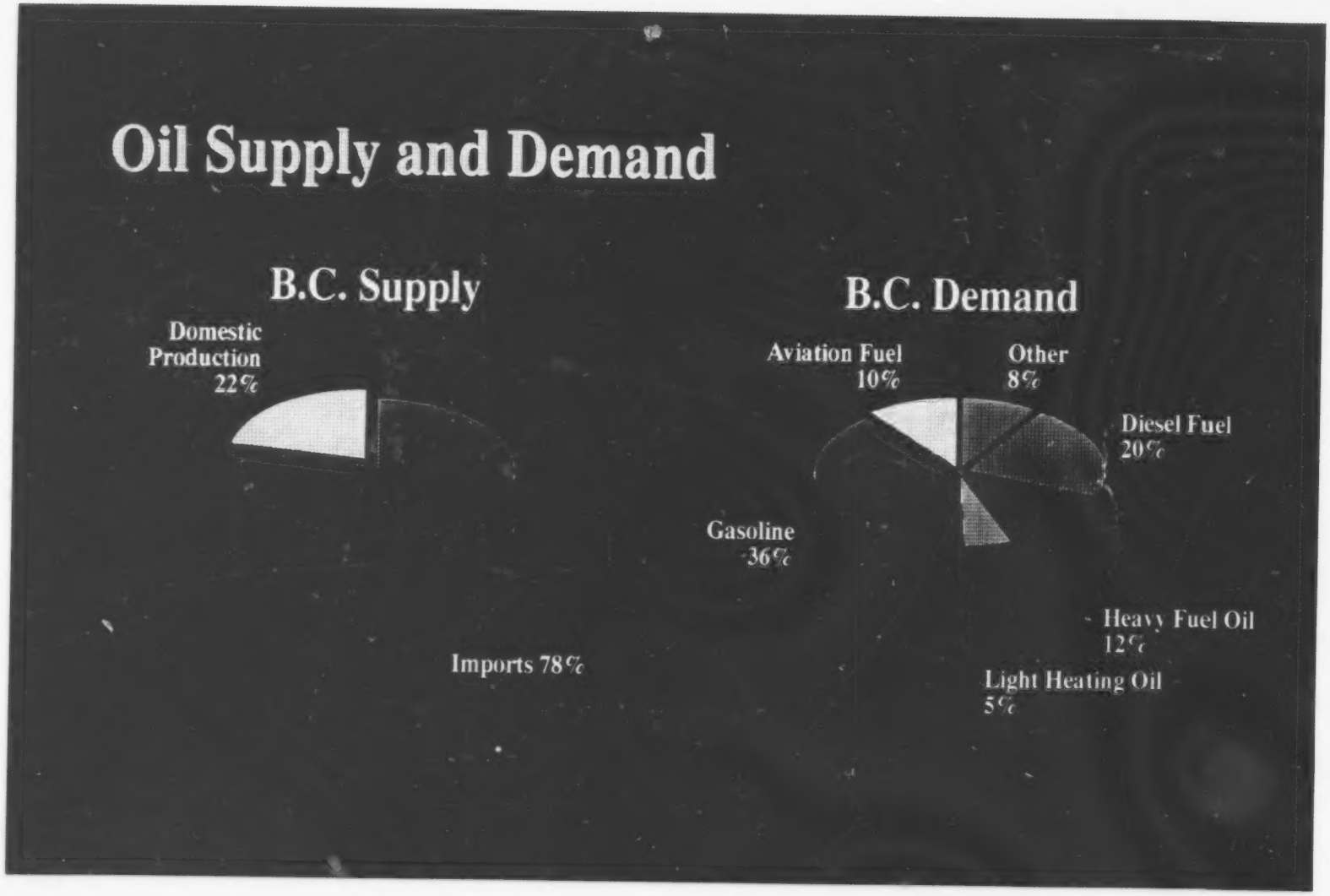
Residential

- Prescriptive requirements (minimum R values)
- Cost-effective
- Climate and fuel sensitive

Commercial

- ASHRAE/IES Standard 90.1-1989
- Prescriptive and performance paths

Slide 9


Oil Supply and Demand
B.C. Supply
Domestic Production 22%
Imports 78%
B.C. Demand
Aviation Fuel 10%
Other 8%
Diesel Fuel 20%
Gasoline 36%
Heavy Fuel Oil 12%
Light Heating Oil 5%

Slide 10

Oil and the Environment

- Land use impacts
- Water pollution - oil spills, run-off
- Greenhouse gas emissions
- Acid rain
- Urban air pollution

Slide 11

Fuel Smart

Objective:

- Reduced oil consumption and increased energy efficiency

Benefits:

- Lower energy costs
- Reduced environmental impacts
- Enhanced energy security
- New business opportunities for British Columbians

Slide 12

Fuel Smart

Ethic Change

- Awareness and education

Partnerships

- Government, business and interested parties working together to deliver programs

Slide 13

Programs With Partners

Ride Share
- Pilot projects at Simon Fraser University and in Victoria

Driver Training
- ProTrucker

Fleet Management
- Route planning

Government Vehicles
- ATF purchasing, emissons reductions

Slide 14

Questions Directed to Peter Ostergaard and Warren Bell:

Question: I have two quick questions. We have a methanol plant in Kitimat, and I think we export all the methanol we make there, and I'm wondering why we're not using methanol in B.C.

Peter Ostergaard: It's probably transportation economics that limits the amount of methanol that we do use in B.C., I think Mohawk is the primary buyer of methanol, most of which comes from Alberta producers. The methanol that is produced by Ocelot in Kitimat, because of its port location and its long-term contracts, goes outside of the province. You cannot build a plant like that without some long-term assured contracts.

Question: But methanol is an alcohol, and is bio-degradable. It would be very efficient in our automobiles, especially government automobiles. Why doesn't government have an incentive to encourage that?

Peter Ostergaard: We have an incentive with most alternate fuels and that is the incentive of not having the provincial motive fuel tax on it. Methanol is slightly different. We're told that the Indy racers in Vancouver, at the Molson Indy last September, were charged an automotive fuel tax on the methanol they used for the cars, and we're trying to get that changed to encourage methanol as an alternative fuel for vehicles.

Question: My other question relates to wood. In British Columbia, we're presently cutting around 100 million cubic meters of wood every year, and we're shortly going to have to reduce that rate to something sustainable, probably by half. So what is B.C. Hydro going to do for alternative fuels when there is no more wood waste for the co-generation of power at these pulp mills, when this wood probably belongs back in the bush as fertilizer for growing trees.

Peter Ostergaard: That's a question of considerable debate amongst our Ministry of Forest people, and it always comes up whenever you're trying to do a decent inventory of the resource and assess the percentage that will be available in future to use for power production.

The plants that are being proposed and built now are being sized very conservatively, to ensure that under the most pessimistic scenarios, those plants will still have an assured fuel supply. For example, the Williams Lake plant can be backstopped by waste wood from Quesnel, if necessary. Even though the Williams Lake plant will be fuelled, over the short term, by the five sawmills in Williams Lake, there are provisions to haul wood waste the 75 miles from Quesnel by backhauling the chiptrucks from Quesnel to the wood waste co-generation project in Williams Lake.

Question: So there are no long-term plans for using alternative fuels at the co-generation plants?

Peter Ostergaard: For the pulp mills? You'd have to ask them about their plans.

Question: A question for Warren Bell: Appliance efficiency; who does the testing?

Warren Bell: The testing of appliances and other products regulated under the Act is primarily done at the manufacturer's plant. The standards have been developed primarily by the CSA and CGA. Those agencies conduct their tests at the manufacturing level, to make sure that the appliances and equipment do meet the standards.

At the same time, we'll be doing some testing here, a little bit of random testing, just to make sure that, for one, the appliances are being labelled, and second, that they do indeed meet the standards. But the primary testing is done at the manufacturing level and is enforced by the CSA.

Question: Mr. Allan said at lunch, and you have repeated the assurance, that private power generation would be subject to public hearings. Does this mean that the Kemano 2 project will finally be subject to public hearing?

Peter Ostergaard: The Kemano 2 Project is not the same as the Kemano Completion project, now under construction. I assume you mean Kemano Completion. Kemano 2 included diversions from the Morice and Dean river systems to the south. The Kemano Completion was contemplated in the Water License granted to Alcan in 1950. It was further 'grandfathered' under the Utilities Commission Act, when the Act was passed in 1980. Unless the Federal Government changes its mind, the Province, by legislation, will not be subjecting Kemano Completion to a public hearing under the Energy Project Review Proc-

ess, because it's not required in law.

Question: Fuel Smart: Why is there not more focus on the development of geothermal energy? Isn't it the cleanest source of energy?

Peter Ostergaard: Geothermal energy was, of course, much touted in the 1970s, with B.C. Hydro's involvement in deep drilling at Meager Creek. Is John MacRae here? Did you ask that question, John? There is likely going to be a well drilled this summer at Meager Creek by the people that took over B.C. Hydro's rights, Canadian Crew Energy Corporation. We'll watch that with interest. There's nothing stopping geothermal development, it's just that it's not being singled out as a favourite by anybody. Why should geothermal take precedence over wood waste or any other alternative source of electricity?

We recently received a request for posting for a geothermal drilling program at Lakelse Lake, south of Terrace. We granted the rights to Fairbank Engineering, but because the company wasn't able to resolve issues concerning land use conflicts with adjacent land owners, we were unable to allow the drilling to proceed.

There's no reason why the Province would not permit drilling for geothermal exploration. But that's entirely different from coming to us and asking for subsidy money to help you do geothermal exploration.

Question: Thank you. One last question. What initiatives are being taken to require real estate 'mega-developments' to include passive solar collectors in their building designs?

Peter Ostergaard: If you're talking about passive solar energy, in terms of residential construction, under the new building standards that Warren was talking about, we would be having them prescription-based.

I suspect that what might happen in a couple of years, particularly in coastal locations like Victoria, where people want large numbers of windows on one side because of views, we may be having to switch those from prescriptive standards to performance standards, and that's when passive solar collectors may come into the formula.

Until then, what's being proposed is: 'Here's what you have to achieve in terms of our values of insulation'; but in future, we may be saying, 'Here's what you have to achieve in terms of kilowatt-hours per cubic metre of internal air area', and at that point, the proponent may have no choice but to build passive solar collectors.

Thanks by Einar Field: Thank you, Peter and Warren, for insights into the policy directions for the 1990s. It was very enlightening.

Thank you both very much.

Information On the Discussion Groups by Einar Field:

We're running a bit late, so I'll ask Mr. Jim Savage to come up and give us a some brief instructions for the discussion groups which will complete this afternoon's program.

Jim Savage: I'm going to make this very short. First, I'd like to announce that regrettably, a major blizzard has just started outside, making the sidewalks impassable; which means you're all going to have to stay here and participate in the discussion groups.

We've got some good, clean fun lined up, and I was planning on outlining the objectives and all kinds of things, but you'll find out about that in your assigned work rooms. Lists of group members and room assignments are posted out by the registration area. So off you go, and let's get on with it.

Thank you.

Einar Field: Just one quick reminder that the Pearson College of the Pacific Choir and Folk Dance Group will be here tonight at 7:30 pm, so I hope to see you all then.

Thank you.

EDUCATION AND PUBLIC CONSULTATION

Business and Education: An Investment in Tomorrow

Marge Qualls

Director of Consumer Affairs, Puget Sound Power and Light

Opening Remarks and Introduction of Marge Qualls by Einar Field

Good morning, ladies and gentlemen, and welcome to the third and final day of the Electric Energy Forum.

We look forward to another good day, and I hope that in addition to enjoying the Forum you've also had the chance to enjoy the beautiful city of Victoria.

The speakers have covered their topics in a very interesting manner and all have been informative. They've also provided us with some new horizons and challenged everyone personally to contribute to solutions.

This morning we continue to focus on education but now add a new dimension; that business investment in education is an essential component to future success. Here to address us on this very important subject is Marge Qualls. Marge is Director of Consumer Affairs for Puget Sound Power and Light Company.

Ms. Qualls graduated from Washington State University with a B.A. in Education and obtained her Masters of Business Administration from City University. She joined Puget Sound Power and Light in 1965 as a home economist and since then has held managerial positions in energy information and customer-related sectors of the company. Marge Qualls is active in professional and community organizations including the Edison Electric Institute and the Belleville Community College Foundation.

Ladies and gentlemen, please join me in welcoming Marge Qualls.

Business and Education - An Investment in Tomorrow

Thank you and good morning.

I've been asked to talk about how my company, Puget Sound Power and Light, gets involved in education, what programs we offer and what makes them work.

Before I talk about the **hows** I'd like to answer another question that I'm often asked, and that is **why** Puget Power is so involved in education.

My answer is for the same two reasons that **any** business involved in education would give; it is good citizenship, and it is just plain good business.

Support for education is one arena in which the need for business to be a good citizen happily coincides with the needs of business to make itself as good and as successful as it can be.

That's because only by meeting the needs of the customers and communities that we serve can a business hope to stay in the race.

The 19th century thinker George Peabody said, "Education is a debt due from present to future generations." But business involvement in education is more than payment of a debt, it's an investment.

A little girl on a bike rolled up to a roadside watermelon farm and the sign read "Fresh water-

melons, right off the vine." She hopped off her bike and strolled around, looking at all the watermelons. Finally, she pointed to the biggest one and asked, "How much is that one?"

"That one," the farmer replied, "will run you $3."

"Gee," said the little girl, "all I have is 30 cents."

The farmer looked around a little and finally pointed out the smallest watermelon in his plot. "You can get that one for 30 cents," he said.

"Fine,", said the little girl, "I'll take it." She handed over the 30 cents.

But when the farmer reached for his knife the girl stopped him. "No, no!" she said, "Leave it on the vine. I'll come back for it in a month."

Business today has a little more than 30 cents in its pocket. But there's no question that a little money invested in education today will save a **lot** of money tomorrow, and the payback will be in the form of productivity and ingenuity.

Investment in education is an investment in the future. Education prepares young people to take their place in our society. To be involved in that process is a matter of survival, not just for individual businesses but for business as a whole. Throughout history, education has consistently been viewed not only as a means for improving the individual but as a means for improving **society**. Why?

Because today's students are tomorrow's **workers**. They are tomorrow's **consumers**. And they are tomorrow's **leaders**, although looking at the ads on television might convince you that they are also **today's** consumers as well.

First I'd like to talk just a bit about workers. Employment is the backbone of a healthy economy and a healthy society. People without productive work are a drain on our economy, and a threat to the social fabric. It is critical to develop an educated work force that can meet the requirements of today's and tomorrow's labour market.

Tomorrow's work force is a growing concern for all of us. The US labour force, for example, exploded by nearly three percent a year during the 1970s, as the Baby Boom generation went to work. In the 1990s it's projected to expand by only one percent per year.

Eighty-five percent of these new entrants will be minorities, especially immigrants and women. Over the next decade, the work force will become older, more female, and more disadvantaged. That new work force brings new challenges for business; child care needs, language barriers, and cultural differences.

Along with the demographic changes, business needs are changing as well. At one time, businesses needed workers trained only in basic skills. Now we require people who can reason, learn new subjects, work collaboratively, think on their feet, and find answers to hard problems with no single solution.

An investment in education today is critical for business to maintain a competitive edge, to continue to progress, to find new ways of serving customers better and to find more cost-effective ways of just doing our business.

We have to have a well-educated pool to draw from and that's why we in business must be involved in education. We must support teachers and schools in every way. We can and we must show today's students that doing well in school has something to do with doing well in business — and in **life**.

Besides grooming today's youth to be tomorrow's work force it's also important to us in business that today's students grow up to be educated **consumers**, safe and efficient users of our products and services.

We want to do all we can to ensure that they can learn early on what the marketplace is like, that they become knowledgeable consumers, well versed in our system of business and the dynamics of a customer-driven economy, able to make educated choices in the marketplace of the future, choices that reflect the **values** we stand for as a people.

In all of this we can't expect schools and teachers working alone to do the job for us. It's **our** job as much as the educators to see that young people are prepared to live in tomorrow's world, prepared to be tomorrow's world.

Whitney Griswold said that the only sure

weapon against bad ideas is **better** ideas, and only education can foster a climate that generates better ideas.

Which brings me to the **third** important point to recognize about today's youth; not only are they tomorrow's workers and tomorrow's consumers, they will also be tomorrow's **leaders**, the leaders of our businesses, our communities and our governments. They're the ones who will be creating new products, making policy, solving problems and forging new allegiances for our society and our nations. We want them to be the best that they can be so that **we** can continue being the best **we** can be.

Aristotle once remarked that the fate of empires depends on the education of youth. Well, there are no more empires today. But that doesn't mean education has failed. In fact, it may be a vindication of one leader's comment that "Education makes a people easy to lead but impossible to enslave."

I think we can all appreciate the vital role of education and educators in shaping today's world, and tomorrow's. But being appreciative isn't enough. We have to give them as much active material support as we can, for when business and education join forces in partnerships it's a win/win proposition. It strengthens our schools and helps build a quality work place, and both of those make our communities better.

So: what can business give to education? Well, in a word, no, in four words: money, time, resources and commitment.

First, **money**; in the form of contributions, not just thrown at a problem blindly but directed carefully toward the kinds of programs that will turn today's student into tomorrow's consumer, worker and leader, and by taking care how that money is spent. Business cannot only give money but expertise and vision as well.

Second, **time**; in the form of individual volunteer efforts of company employees from the top right on down. Working on behalf of education is a very special kind of volunteerism. I emphasize from the top down because it's up to the leaders to send their employees the message that community involvement is an **essential** of contemporary business.

Third, **resources**; in the form of tailor-made educational programs, cooperative programs and partnerships with educational institutions, participating in programs like Junior Achievement and Business Week, opportunities for student internships and career orientation; in short, a corporate helping hand to the workers, the consumers and the leaders of tomorrow.

Fourth, **commitment**; a strong continuing commitment in the form of community and political leadership, legislative action, the kinds of things that business people, business leaders and government have the power to do.

Commitment means something else, too. It means a willingness to share responsibility. As the school system's primary consumer, business must be prepared to share the responsibility for the **quality** of education. To the extent that we provide education with our money, time and resources we take on a responsibility to do more than criticize the results, to become personally involved in securing the **best** results.

Well, now for that other question, how Puget Power gets involved in education and what we're doing.

The growth of energy awareness in 1970 has dramatically increased the demand for energy education programs. For years Puget Power had already offered schools and community groups the basic electric safety program. During the 1980s, though, Puget Power's education services program was broadened a good deal to include a wider variety of topics.

The most popular classroom presentation requested is still the topic of electric safety. In the past five years school requests for electric safety programs have nearly tripled. But elementary, junior high and high school educators teaching subjects such as science, social studies, reading, math and home and family life now constantly request company speakers, who are employees from all over the company in all kinds of jobs, who reached over 160,000 students in 1990.

Teachers also attend Puget Power workshops and they utilize energy-related curricula to teach students about conservation, safety, how electricity is made, energy efficiency, meter reading, energy in business economics careers, environmental issues and many more.

Since 1983, Puget Power has offered elementary schools full **assembly programs** for every student in the school on the topic of electric safety and energy conservation. We use a performing arts consultant who conducts 150 safety puppet presentations in the schools each year and he alone reaches 40,000 students and faculty a year. Performances are also held at various shopping malls, fairs and at other large public gatherings.

Tours of our historic Snoqualmie Falls hydroelectric plant are a popular request received by our education services people and several times a year school districts that we serve use Snoqualmie Falls as part of their science and outdoor education exposure.

Puget Power distributes a quarterly **teachers newsletter** by direct mail to over 5,000 teachers, advising them about new programs, curriculum, film, videos, workshops, et cetera, that we may be sponsoring or co-sponsoring with another organization.

Our **Teachers Resource Guide** highlights and describes the educational materials and programs we offer schools. The guide tells teachers what type of information is available and the grade level it is designed to reach. Teachers can request classroom speakers, check out films and videos and order specific curriculum kits complete with lesson plans and student activities.

Puget Power's **teachers workshops** are popular events that many teachers look forward to all year long. Workshops provide teachers with updated curricula and information to help supplement their lesson plans. Over 30 organizations other than Puget Power display their educational offerings during these workshops as well. Then a keynote speaker highlights the event.

Business Week and **Junior Achievement** are two long-time programs that have been supported by Puget Power for years. These are programs that were developed outside the company. Employees become directly involved in educating students on the importance of business, economics, and the free enterprise system. Our education services department provides curriculum materials for these employees who volunteer to teach business economics in the high schools through the **Business Week** program.

Since 1981, Puget Power has been involved in **working with learning-disabled and handicapped students** to provide a positive learning exposure and training in preparation for future employment. This program has involved a partnership of private industry, county government, students and their parents from various school districts. Because of this positive work/training experience, a number of these disabled students have entered the work force in full time paying jobs.

Many Puget Power employees are also directly involved in working on numerous **education committees, organizations** and task forces at all levels, local, state and national. Our Chairman and CEO, John Ellis, heads the Education Task Force for the Washington Round Table, an organization of leaders from the State of Washington's largest 100 companies, who are active in a variety of public issues. And, of course, following Mr. Ellis's lead, Puget Power has established **partnerships** with many school districts throughout our service territory whereby we undertake joint projects, welcome students into the company work place for orientations and internships, send our employees to local schools for presentations, that I mentioned earlier, and we give contributions and match employee contributions to different colleges.

Our entire Education Services program recently underwent a five-month in-depth review and evaluation and a comprehensive report on the findings and recommendations that resulted. Of particular importance, this study involved **company employees** and **teachers** as part of a strategic planning process for the nineties.

The study weighed the strong and the weak points in our programs. The company's willingness to be responsive and establish long-term partnerships with schools, with school districts and with education organizations was considered extremely important and one of Puget Power's main strengths.

Another point I mentioned early on is the continuing need that education has for outside funding; **money**. Corporations have a real opportunity, if not an **obligation**, to put our money where our mouth is, so to speak, just as B.C. Hydro did last night in this very room, following the conclusion of the wonderful Pearson College of the Pacific show.

Puget Power's strategic plan for corporate contributions has as one of its top priorities support for education. Corporate contributions are made from shareholder money, what we call below the line. Our corporate financial contributions to education come in a variety of forms, falling broadly into four categories:

- **Employee gift-matching,** whereby the shareholders match, as I said, dollar for dollar to a certain limit, an individual employee's contribution to a qualifying educational institution.
- **Funding for non-profit organizations** that benefit private higher education.
- **Direct support** to state-funded colleges and universities such as the University of Washington, Washington State University or Western Washington State University in Bellingham as a few examples.
- **Donations** to community college capital campaigns and faculty award programs in the form of onetime gifts or they may be multi-year pledges.

Some of our corporate financial support for education does come from above the line, not from shareholder funds. These contributions are for programs that benefit the company directly:

Examples include research and development projects and special engineering programs such as those encouraging women and minority engineering students. We also contribute in-kind services such as printing, and we directly support college computer training programs from which we also hire many employees.

Well, the list goes on and on and I'm sure that most of your organizations are involved in similar kinds of activities to support and benefit education. So let me quickly move on to a slightly different but equally important corporate tie to education: **conservation education**.

Although economics vary from region to region there is no question that **conservation** must play a major role in any future energy strategy. In our region, which until recently enjoyed a substantial surplus of electric energy resources, conservation has long been an effective way of avoiding the cost of building new generating plants. At Puget Power, we treat energy saved as energy generated. We started our conservation program in 1976 and have been promoting conservation ever since, and have been recognized as a leader in the industry. Recently we've also begun aggressively promoting energy efficient technologies to save even more energy.

We recognize, though, that promoting conservation and efficiency among our customers is only a short-term solution, that a conservation ethic is meaningless unless we also impart it to our younger citizens, and early enough that it becomes a part of their way of life by the time they reach adulthood.

That's why we put a lot of emphasis on conservation and energy efficiency in our classroom presentations and our energy curriculum development efforts. It helps school kids form good energy use habits now so they don't have to be re-educated later on. Teachers and parents often tell us that the students and children are the ones who remind **them** to turn off the lights and to have good energy use practices.

Besides providing us with an economic way of meeting customers' demand for power conservation is also a way of expressing our growing concern for the **environment**, for the need to protect, preserve and use wisely nature's resources. A kilowatt–hour conserved is a kilowatt–hour that doesn't have to be generated by burning coal, for example.

But environmental questions, and their answers, aren't easy ones, and they're getting tougher all the time, as the needs of a growing population in our region collide head on with quality of life concerns.

In a recent speech on the environment and the economy, the Canadian economist J.W. Chuckman noted that part of the solution to environmental problems is, and I quote him, "...A realistic assessment of what is and what is not a true environmental hazard, ...For this," he said, "we need information. There is no substitute for good information in developing intelligent policies."

In the current wave of environmental consciousness, business has tended to give the most emphasis to those environmental issues that get the most **publicity**, not necessarily those that present the biggest **problem**. The news media also tend to cover the issues that get the most attention, not necessarily those that present the biggest problems.

The news media, tending as they do to cover the stories and issues that are the most sensational and spectacular, often skew the public's perception of risk. Airplane crashes get a lot more attention than automobile accidents even though driving a car is an astronomically greater risk that flying. Similarly, nuclear power plant operations, electromagnetic fields and hazardous waste measured in parts per trillion get a lot more publicity these days than the design, production and operation of gasoline-powered cars and trucks, even though experts tell us that these things pose considerably smaller environmental risks than do air-polluting cars and trucks. We need to recognize, and enable the **public** to recognize, that environmental questions are **economic** questions. We have to weigh the environmental and the **economic** impacts of each proposed way of producing or transmitting electricity. We must never settle on one solution as the final one but always research and explore **new** ways, **better** ways. That, of course, means spending money. **Everyone's** money. We will all stand up and cheer for the environmentally-safer ways of doing things, but will we pay the cost of developing them?

Well, one way we can pay for the cost of developing them, and it's a bargain at twice the price, is through **education**. Sensitizing young people to environmental realities and to tough environmental questions is the best way of creating the atmosphere in which those questions are going to be answered, those problems solved. Our own solutions may be short-term. It may be well into the next generation before we find long-term, even **permanent** solutions to many of our contemporary environmental dilemmas.

The time and money we invest in environmental education today quite literally means a better and cleaner world for tomorrow.

Another way that our involvement in education points toward a better tomorrow is that it enables us to encourage young people toward careers that may otherwise remain unknown, unexplored, out of reach for them, careers as engineers, ecologists, biologists, energy planners, corporate executives, careers that if pursued will give the world of tomorrow the capable leadership and work force it will need to face its own crises.

Puget Power employees from every part of the company frequently participate in **career planning programs** at schools in our service territory, providing young people with information on career fields and what training they will need to prepare for those careers. Besides helping young people make decisions about their lives, in-school career presentations provide the beginning of the all-important transition from school to work.

We provide later steps of that transition through college internships, summer jobs and our own engineers-in-training program.

Well, those are only a few of the ways Puget Power and lots of other businesses like us are involved in education. Partnerships between businesses and schools, both public and private, are the key to bringing the world of school and the world of work closer together. That makes for a more unified citizenry, a citizenry properly prepared to play its part in the economic life of its nation, to strengthen that nation, to transform it and quite possibly to transform the world.

Thank you very much. And I would be happy to entertain any questions you might have.

Einar Field: Thank you, Ms. Qualls. I'm impressed by the commitment and involvement of your organization and their contribution towards education.

Thank you for sharing both the exposure and providing the insight into what business can do in terms of positioning itself for success both with its own work force, its consumers, and also with the future decision makers. Thank you very much.

Questions Answered by Marge Qualls After the Forum

Question: I agree that a unit of energy saved is equal to a unit of energy generated. But how do your shareholders react? For a private utility, increased profits follow from increased electricity sales. So doesn't it cost Puget Power money to promote conservation?

Marge Qualls: You're right. Conservation measures and conservation promotion cost money. But not as much money as developing new sources of electric generation. In accordance with Puget Sound Power and Light's least-cost plan, conservation is the top priority power source for the future because it is the least-costly method

of obtaining new electric energy. Both the customers and shareholders win with this scenario.

Question: Could you please elaborate on your reference to the unemployed and their role in society?

Marge Qualls: Actually, my reference was to low income families as one of the many diverse groups who will benefit from more effective energy education. As I stated earlier, it has been statistically proven that to effectively reach as many customers as possible with a message, utilities need to target and direct their information messages specifically to as many of these groups as possible.

Our goal should be to educate these customers about how to use electric energy more wisely, as well as how to get assistance if there should be a need. At Puget Power, we provide this kind of information through social service agencies who service low income clients

Communicating With the Public in the '90s

Chris Boatman

Vice-President, Corporate and Environmental Affairs, B.C. Hydro

Introduction of Chris Boatman by Einar Field

For B.C. Hydro, our customers are both our shareholders and our clients, and how we interact with them is critical to our current and future direction and performance. 'Communicating with the Public in the '90s' is the title for our next address. Mr. Chris Boatman is our next speaker.

Chris Boatman is the Vice–President of Corporate and Environmental Affairs and Executive Assistant to the Chairman of B.C. Hydro. Between 1965 and 1984, Mr. Boatman was involved in the development of the Peace and the Columbia River projects. In 1973, he was appointed Construction Manager for the Peace Canyon Project and in 1980, Project Manager for Site C.

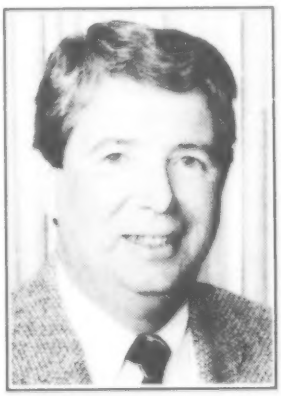
In 1984, Mr. Boatman was appointed the manager of B.C. Hydro International Ltd., a subsidiary company of

B.C. Hydro involved in offshore consulting services. In 1986, Mr. Boatman joined the office of the Chairman and CEO as Executive Assistant to the Chairman and President. In 1988 he was appointed President and CEO of the British Columbia Power Export Corporation, (POWEREX).

Mr. Boatman graduated from the University of London with a degree in civil and structural engineering.

Ladies and gentlemen, please welcome Chris Boatman.

Communicating With the Public in the '90s



Good morning, ladies and gentlemen, and thank you, Einar. My presentation to you today is on, as Einar said, 'Communicating with the public in the '90s.' What do we mean by communication?

Let me start with a little story about communication in B.C. Hydro. I think it's changed quite a bit in the 20 years since I've been with the company. We used to communicate by going out and telling people that we had built something. For some reason, they got mad at us. We thought they were ungrateful, because we believed that we had built it for their benefit.

So we thought we'd take a different approach. We started going out and telling people that we were planning to build something, and for a long time we wondered why they still got mad at us. So we said, how come we always seem to be part of the problem, how can we become part of the solution?

I think we then realized what the problem was. We were communicating to people instead of communicating with them. I believe we must talk with people first, to determine if they believe there is a problem, and to see then if we can be part of the solution. In other words the communication element must be introduced at the beginning of any process and must be a fundamental and ongoing part of all our public consultation processes.

So the buzzword about communications in the '90s is **listening**. That shouldn't be a surprise to anyone. Listening has always been the most important part of good communication, but hardly anybody ever thinks of that. Listening does work better because it helps you make better decisions

on how to answer people's needs.

But of course, like many other good things, it has some down sides, it takes longer. After all, despite what some people have accused us of in the past, I don't believe we build dams and power lines and substations just to keep a building full of engineers busy. When we build anything, I believe it's a direct result of responding to a need, generally a need for electricity by our customers, in one or other part of the service area.

The distinctive thing about our business is that we have to think about problems well in advance, because if there's a need for a transmission line, it takes five years to get it designed, sited and built. It takes 15 to 20 years if we have to build new generation. Not many other businesses that I know of have to deal with these kinds of lead times. I think most people don't seem to think of electricity in these long-range terms.

So, again, we must start the dialogue with the public to determine their needs and to agree on ways to provide for those needs, well in advance of any perceived need on their part. Let me give you a recent example.

Our system planning people told us that with our forecast of growth in the Lower Mainland the system was becoming stressed and would need electrical reinforcement. That meant building a new transmission line. Before we could start any public consultation process, two of the affected municipalities elected councils on 'no-growth' or 'controlled development' platforms. They questioned our forecasts of rapid electrical load growth within their boundaries. So you can imagine the reception we would have received if we'd gone in there to tell them that in our opinion they needed a new transmission line to meet their electrical growth.

Again we must start to communicate with those people and decide together if there is a problem. We're going to start a program of talking to people in the Lower Mainland municipalities about what they **really** mean by 'controlled development'; what do they see as the future for the Lower Mainland; and what part is electricity going to play in that future?

Usually, when I meet people and they find out I work for Hydro, the dialogue starts. In my defence I usually ask them two questions; the first is, 'When you turn on the light switch how often do you think that the light won't go on?' Their answer is almost always, 'Never.' So the second question is, "Well, once the light goes on, how often do you ever wonder about how the energy got there?'. Once again, the answer is almost always, 'Never.'

I believe as a society we've taken electricity for granted. Maybe that shows that electric utilities have generally done a good job of providing service, but maybe not such a good job of explaining to people or involving them in the process, and have them understand the long lead-times necessary for us to continue providing that service. People just assume electricity will be there when they build their homes, their offices, or their factories.

I've talked about our definition of communication and how it's changed over the years. Today that means that when we communicate with the public, we must try to discuss the choices available; not the solution that we may think is the right one. We want to see first of all if we can even agree that there is action that must be taken, and then if we're agreed on that, we can attempt to work out a mutually acceptable solution.

That's communication, but what do we mean by public? Who do we need to be communicating with? Listening to and informing all those who need to know what's going on in the business means more than answering questions from the media and more than just meeting with residents who live near our facilities, either existing or proposed; even though those two are obviously important.

There is no such thing as the general public. There are many publics. We call those publics, or segments of society, which have a particular interest in our business our **stakeholders**, because we recognize they have a stake in what we're talking about. By listening to them, and informing them, we can reach better decisions. Listening and informing, you might call it talking; is not an easy job, but of the two, listening is tougher.

That's because listening is a discipline that doesn't come easily to most of us; and on top of that, you have to deal with what you hear.

However, there's a real danger in our society of being misled by the views of single-focus groups,

who are often vocal well beyond their numbers. We must be careful not to be misled by their stridency and inadvertently force the views of a vocal minority upon the silent majority.

One of the ways to attempt to assure a balanced approach and to cut down on that potential for error is to separate those segments of society with whom we must interface into various stakeholder groups.

As in the case with any business, Hydro's number one stakeholder, or public, is the customer. You can be a member of more than one public and I think most people here would belong to more than one customer class.

We provide customers with electric service and then with bills. We have to provide ways for our customers to express their concerns about that service or their bills. So we have employees assigned the very important job of listening to customers in our more than 50 local offices around the province. This public also breaks down into categories, not just by geographical regions, but into customers such as industrial, commercial or residential.

But we're not going to get far in communicating with anyone unless our own employees know what is going on. Employees have relationships with family, friends and the public, too.

That's why we've developed methods, both formal and informal, to listen to employee views and to seek their input in decision-making. That's why we've changed our management approach to allow decisions to be made by those who have the best information to make such decisions. That's why we continue to maintain communication programs with electronic and print media to keep our employees fully informed.

I don't want to try and list all the stakeholders but a couple we should recognize, that is as a Crown Corporation, our shareholder is the Government of British Columbia. Policy direction is provided largely through the Ministry of Energy, Mines and Petroleum Resources, one of the co-sponsors of this Forum. In addition, we are in frequent contact with many government ministries, and obviously it is essential that we keep conversant with their policies and that we keep them advised of our activities.

So the public that we're trying to reach is actually made up of a number of different groups, often overlapping but each with its own particular needs and interests. But what does all this have to do with the theme of our forum of the year, electricity, education and the environment?

I think that our theme is very appropriate, because all this communicating we're trying to do is a form of education, both for us and for those we communicate with. Communication is how we learn about one another's viewpoints on important issues that affect our business. It's how we learn about the concerns of our customers.

I've been talking about what we do to communicate today, but I also recognize that my title was, 'Communicating with the Public in the '90s', and the '90s have only just begun. Will communicating in the '90s be different than before? I would answer, 'Yes and no.' Good communicating has always involved listening and talking; that will not change.

What has changed in our approach at Hydro is that we're gradually discovering the value of listening. Over the years I've been with Hydro, we've changed the way we think within the company, what you could call the corporate culture, to one that is more open, one that includes input from others and one that reflects the diversity of the communities and publics that we serve.

Perhaps the communication challenge of the '90s is to manage how we, as a society, perceive the use of electricity as it relates to the environment. We know from listening that the environment is a major concern of all our publics. We know that the generation and distribution of electricity affects that environment. Because of the environmental cost and the impact of that cost on electricity prices, we can assume that people have a vested interest in being efficient in the way electricity is being used, but we must recognize that it's not our role to preach. It is our role to inform.

It is our job to tell the public what the choices are and to work with them to determine solutions. So communicating in the '90s requires an acceptance of the simple fact that the primary purpose of communication in a corporation like B.C. Hydro is not to persuade or sell but to inform. Communicating in the '90s means being flexible and responsive to the public's changing needs.

Communicating in the '90s means the complete acceptance of the fact that what you have to say is every bit as important as what I have to say. These Forums, over the last four years, have been attempts on our part to provide opportunities for this type of communication. I know that it must seem to you that we put a lot of people up here to talk at you, but I hope that in the workshops and discussion groups, we'll provide opportunities for you to communicate your views to us and for us to listen. Thank you very much.

I understand I have some time for some questions if anybody would like to ask me a question.

Question: How many hydro engineers have had retraining in environmental studies and the study of ecosystems?

Chris Boatman: We have a gentleman in our midst, Dr. Zig Hathorn, Hydro's Manager of Environmental Resources, who I'm sure could answer that question much better than I. One of the fundamental roles of our Environmental Resources Division, which has over 30 professional staff, is to get involved with our engineering operating staff and customer service groups and to promote environmental ethics by talking to them and putting on courses for them.

We have an environment awareness program that is working throughout the corporation. It's an ongoing thing. We believe that the environmental ethic must be understood by every employee within B.C. Hydro.

I believe that we now see environmental ethics as part of our daily business. There are opportunities through our Environmental Resources Division for all employees to get information and training on environmental matters.

Question: The Site C project has experienced many styles of communication strategies by Hydro over the years, starting with the old 'build it and then tell the public'; and continuing on to today's consultative style. In light of the poor public response to Hydro's old strategies for Site C, and other projects that have been active for years, is it possible to use the new communications style to 'turn the public around' for these projects?

Chris Boatman: Is it possible to turn them around? I'm not quite sure of the questioner's point of view. Is he opposed to Site C, and is he wondering if our communication dialogue will, in due process, turn the public opinion around so they're for Site C? If that's the gist of the question, I'm not sure that we expect to 'turn them around' in the sense of changing their 'against' position into a 'for' position.

I think the best you can hope to do is to explain to them why such things are necessary. That's what I was alluding to when I was talking about discussing problems and see if there is common ground.

Do we need additional generation in British Columbia? If we do, what are the choices? Obviously the choices we've made in recent years moved Hydro towards conservation and energy efficiency. But at some point in time, are we going to need another generating facility? Can we reach agreement that it is necessary? Can we then reach agreement as to the best way to provide that? You're never going to turn everybody around. We're all human and sometimes if it's in our back garden, we're not overly happy with it being there, even though we understand why it's necessary.

Question: You spoke of being careful about 'single-interest groups' that are vocal beyond their numbers, how do you think Canfor, Weldwood, Fletcher Challenge, MacMillan-Bloedel will react to a lessening influence?

Chris Boatman: I don't get any salary from any of those companies, do I? But I think that perhaps the comments I made about listening apply to all of us.

I think that if it takes small vocal groups to get people to pay attention, then that's the way people have to go. I think that it's every business's responsibility to listen and respond to the society and environment we live in. If we don't, we'll soon be out of business.

In saying what I said about small vocal groups, I was not trying to imply that they weren't a vital and necessary part of our society. What I was saying was that we can't have one minority view, that might have been ours, supplanted by another minority view. We're looking for the views of the majority, as best we can determine it.

Question: Does B.C. Hydro or its Power

Smart program commit funds to a B.C. school educational program to promote conservation ethic in the classrooms?

Chris Boatman: Well, Einar, perhaps you should answer that question. Einar is the gentleman with the budget.

Hydro sponsors our Partners in Education program. We're looking at a variety of programs to fund. I'm not sure we've addressed that one specifically, Einar, but certainly we are prepared to look at anything that will help reach the objectives of that 'Partners in Education' program.

Einar Field: I agree with Chris. I don't think there's any question about whether we would like to promote the conservation ethic in the classroom, we certainly would.

That's the last question we have. Thank you very much, Chris. It's a changing world out there, with new expectations for involvement by the stakeholders. I thank you for sharing your thoughts on how we can interact better with both the public, our customers and our employees.

Einar Field: The remaining part of the morning will be spent in discussion groups. For those of you who attended yesterday's groups, please return to the same group you were in yesterday. For those of you that were not able to attend, please join the group that you were initially assigned to. For those of you who are uncertain about which group you're in, please go to the registration desk for further instructions. Thank you. This morning's session is adjourned.

Questions Answered by Chris Boatman After The Forum

Question: The 'old' way B.C. Hydro operated provided us with fairly low residential rates. I am concerned that we now may be seeing a government-directed effort to hike our rates in the name of an 'efficiency ethic' to force conservation and raise a lot of new revenue for the government from increased residential rates. Are your residential customers going to like this?

Chris Boatman: B.C. Hydro's residential electric rates are now among the lowest in the world. While Canada's consumer price index has increased at a rate of about 4 to 5 percent annually recently, B.C. Hydro's electric power rates have increased at less than 3 percent annually. After the rate increase in April 1986, there was a 3 percent increase in November 1989, and further increases of 1.5 percent in both April 1990 and April 1991. Since 1986 the consumer price index has increased by about 25 percent, while residential electric rates have grown by little more than 6 percent.

In terms of purchasing power, electricity is thus about 15 percent cheaper now than in 1986.

But if B.C. Hydro has to build another major hydroelectric facility, our rates will have to jump, perhaps by 30-40 percent. So it may make sense to try and keep the rates following the cost of living index in order to avoid a "rate shock" down the road.

Remember that Hydro's rates are regulated by the B.C. Public Utilities Commission, and any rate changes proposed by Hydro have to be submitted to the B.C.U.C. for full public scrutiny.

As a regulated Utility, our mission is to support the development of British Columbia through the efficient supply of electricity.

Nobody likes increases in electric power rates, but pricing electricity too cheaply encourages waste, not conservation.

Question: Does Hydro have a commitment to incorporate societal cost-effectiveness into all its decision-making processes? That is, are you committed to taking into account, and communicating your methodology to the public, the total social and economic costs of all your programs and projects?

Chris Boatman: Yes, we are, as well as we are able. But I don't think that putting a dollar value on the full societal impacts of a project is as straightforward as the questioner may think. For example, there is no agreed-upon method of valuing land alienated by reservoirs, or of putting a dollar value on deer or moose habitat.

We now build recreational facilities at our hydroelectric reservoirs. I think that those who use these facilities are grateful. But I'm aware that many environmentalists and native people would prefer that the dam not be there at all.

We all use the electricity the dam creates, but we all would prefer that the dam and transmis-

sion line be located in somebody else's back yard.

But to return to the question, yes, we will try and include all societal costs in our future environmental impact statements, and we will explain our methodology of how we arrived at our societal costs.

LUNCHEON ADDRESS

"WHAT WE OWE OUR CHILDREN"

Luncheon Address

What We Owe Our Children

The Honourable David Mercier

Minister of the Environment

Introduction of David Mercier by J. Guy Rose, Director of B.C. Hydro

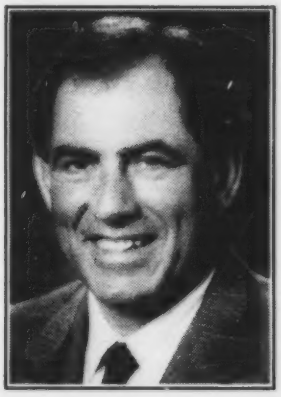
It's my pleasure to introduce to you today our new Minister of the Environment, the Honourable David Mercier.

David Mercier is a chartered accountant and businessman. He was born on July 20th 1939, in Vancouver. He served as an alderman in Burnaby for six years and as the Mayor of Burnaby in 1980-81. He was also Director of the GVRD and Chairman of the LRT Committee for initial development of the Skytrain project.

David Mercier was elected to the B.C. Legislature as MLA for Burnaby Edmonds in October 1986. He has served as Chairman of the Legislature Select Standing Committee on Economic Development, Transportation and Municipal Affairs, and Deputy Chairman of the Select Standing Committee on Public Accounts.

Ladies and gentlemen, it gives me great pleasure to introduce our brand new Minister of the Environment, the Honourable David Mercier.

What We Owe Our Children



Thank you. It is a pleasure for me to be here and to welcome you all on behalf of the Ministry of Environment.

Ladies and gentlemen, the first thing I want to do is just ask a simple question, because I'm new at my Ministry. Is there anyone in the room that can honestly say they did not, since they got up this morning, contribute, even in a small way, to the amount of waste on our planet? I want to see at least one hand. No hands? Thank you. Now, if I had seen one hand, I'd offer that person a position in the ministry so we can find out how it's done. We're all part of the pollution problem.

This is my first opportunity to address a public audience since assuming my portfolio. I can assure you that I view this new responsibility as both a challenge and a privilege. In reading the agenda for this Fourth Annual Electric Energy Forum, I was impressed by the high level of expertise represented by the individuals you have participating on the program. In the brief time I have with you today, I'm going to avoid talking about the specifics of electricity. I'll leave that to those of you who are experts, and who are well represented here. But I do want to talk about electricity, it's production and consumption in the broader context of **environmental protection** and **sustainable development.**

Environmentalists often use these terms interchangeably. There are differences, of course, but they're outweighed by the similarities. Protecting the environment means sustaining it. It also means conserving our resource base so that it can continue to meet the needs of future generations of British Columbians.

What's more, both of these principles are based on the recognition that we hold the environment in trust, and my children remind me of that daily. We don't own it, it's on loan from those future British Columbians and from Mother Nature.

Thomas Edison, who knew something about

people as well as electricity, said there is no substitute for hard work. He said that, 'Genius is one percent inspiration and 99 percent perspiration.' Most people now recognize that it's time to apply the collective genius of humankind to achieving sustainable development. Poll after poll shows overwhelming public support for environmental protection. That's the inspiration, and in politics that's kind of an obvious necessity and a driving force.

We've been inspired to understand the need to change from **resource exploitation** to **resource stewardship**, and I really think we've come a long way already. When you think of what was done in the name of getting the job done as little as 20 years ago, we've come a long way. But we've got a long way to go.

A big part of the perspiration we're going to need to achieve that goal is through education. Today I want to talk about what people have to be educated about in relation to energy use. I also want to touch on some of the education initiatives that have already been launched within the Ministry. But first, why do we need to educate people at all? We need to because in our democratic society, change, and that often means progress, is a matter of choice. We learned long ago that forcing issues will not increase understanding. Imposing solutions from the top down in the end is no solution at all. It only delays reaching true and lasting solutions to our problems.

Freedom of choice is a precious commodity, and one which all British Columbians enjoy. Unlike other precious commodities, however, freedom of choice is not doled out in minute quantities by government to individuals. Citizens today have it in full measure. In British Columbia freedom of choice is a right and not a privilege. It can make things unwieldy and time consuming when it comes to running the province. So many competing interests must be weighed before decisions can be made, but there isn't a second best when it comes to freedom of choice. It's an ongoing learning process for both governments and individuals.

In the end, decisions made by governments acting on the input of informed citizens are always the best decisions. They're best because they endure for a long time. They're best because people understand them and agree on them. They're the reflection of informed opinions. That's why the processes of democracy are so important to maintaining a healthy, high-quality environment.

People and governments can educate each other and keep each other informed on issues. The give and take of information and ideas helps ensure that the best choices are made and that wise decisions and legislation follow.

The place to start with environmental education, of course, is with our young people. The people who will have to live with the result of the decisions we make today, and I think the implication is that the young are going to be living with it longer than I will, since I just passed my first half century.

By reaching people early in life, we can provide them the skills to carry out environmental stewardship far into the future. The professional educators here with us today will bear the main responsibility for delivering that education, and it is an onerous task. We need you all to take on another big responsibility, and that's to build environmental literacy into school programs that are already crowded with essential course material.

I want to go on record now as saying to our educators that the resources of the Ministry of the Environment are available to help them deliver the message. Many of you will already know that the Ministry is not asking that a new unit of environmental studies be layered onto an already burdened secondary program. There's just no room, not enough time in the school day to do that any more. Instead, we're hoping that a better understanding of environmental issues can be woven into existing programs. If you look at all the programs in school, you will find that the environment touches on so many of them. Whichever course you look at you'll see some environmental connection. We do know that children are concerned about the environment and they all want to find out more about the issues, and to be given a chance to discuss them openly and arrive at solutions. There's a place in a science class, in a history class, and even in a law class and others, where there's a requirement for a study of environmental needs. It's right across the spectrum.

For example, the need to preserve bio-diversity is a legitimate issue for study in biology

classes. Are we in danger of endangering the gene pool in plants and animals through over-exploitation and narrow specialization in agriculture? There's no shortage of issues for discussion, ozone depletion and other air-quality concerns, water pollution, toxic chemical use, nuclear waste disposal, alternate energy sources and energy conservation and solid waste management, and the list goes on. Until the last few days I never really knew how long that list was!

Furthermore, in the context of addressing environmental concerns, we can help students learn important processes that are applicable to many other kinds of problem-solving. To think in terms of systems, to learn how to think ahead, and to plan. To think critically; to move away from awareness to action and to work together cooperatively. Above all, we want to make sure these new methods of environmental thinking become second nature to our young citizens.

To achieve that, the Ministry of the Environment is establishing a joint working group with the Ministry of Education. This group will review what is already being done, evaluate its success, and identify new opportunities for building environmental knowledge into the school programs.

We want to encourage class room teachers across the province who have already shown a strong commitment to informed environmental education, as well as those for whom it's a new approach.

We'll also continue to provide environmental and conservation experiences and training to young British Columbians ages 16 to 24 through the 'Environment Youth Corps.' Believe me, if anyone understands the perspiration component of environmental protection, it's the members of the Youth Corps. They're doing the spade work in projects that range from fisheries habitat enhancement to trail improvements, but they're also doing the book work of environmental protection.

Employment in Youth Corps' projects gives young people an understanding of the issues, and also practical training in dealing with them. Members of the Youth Corps are also busy informing thousands of other young British Columbians about the environment through a new project recently begun in cooperation with B.C. Hydro. It's another inter-active program which takes Youth Corps members into school classrooms to promote better awareness and understanding of such topics as pond life, forestry ecosystems, and energy conservation.

This program will build on the successes the Ministry has already had over the years with programs such as 'Project Wild', and other school environmental programs which are in a diverse range of areas, ranging from wild life to waste.

To give just one more example, B.C. Environment has embarked on a major upgrading of the exhibits and visitor facilities at provincial fish hatcheries across the province, which are visited by thousands of school children each year. The new exhibits and accompanying information and education program for hatcheries will encourage people to make the connection, not just between healthy fish populations and high quality outdoor recreation, but also between ecological concerns and their own life styles.

You were going to ask, how does all of this mesh with electric power? It means that people in all walks of life, as consumers of electrical power, have to be educated so that they make the right choices. These choices can have sweeping implications on the environment.

For example, as demand increases for electric power, suppliers are forced to look for more generating capacity with the related potential impacts on the environment. Educated consumers of electricity know that conserving power forestalls the need to develop more generating capacity, possibly for several years. So there's just one connection of many between the educated consumer and environmental protection.

Making the connection is the central theme of our educational programs. We want consumers to make the connection between the choices they make at home and the implications for the environment. We want them to know that when they connect inefficient appliances to their household circuits, they're making a connection that carries environmental implications. It's a poor use of the resource. Multiplied by a million households, it's actually an extremely serious problem. On the other hand, by using energy efficiently, individuals *can* make a difference.

It's at this point that I want to acknowledge the high level of corporate citizenship of B.C. Hydro. Among other things, Hydro has just an-

nounced they will contribute $250,000 this year to the B.C. Environment Youth Corps. The money will be used in part to allow the Youth Corps to continue taking the message of sustainable development into classrooms throughout the province. Through its Power Smart program, Hydro is helping consumers make the connection between choices made in the home and the future of electric power generation in British Columbia. Now, Hydro is also helping our young people to make the connection. Thank you, B.C. Hydro, it's a very wise investment in the future.

In the words of H.G. Wells, 'Human history becomes more and more a race between education and catastrophe.' The race to maintain a high quality environment in a prosperous British Columbia will be a never ending one. Yet, in conclusion, by working together, we can ensure that future generations enjoy the same level of prosperity and quality of life for years to come. Thank you very much. You were very polite. That was my first speech as Minister. Before, when I was Mayor of Burnaby, I never spoke longer than about three minutes, so I appreciate your forbearance.

The next item on the agenda is a presentation. I'd like to call Bob Wyman to the podium. Bob, I'd like to present you with this cap on behalf of the Environment Youth Corps. It's about a size 15. When you're chairman of a big corporation, you have to get smarter all of a sudden, right? Your head gets bigger, as mine did.

I'd like to thank you very much for the contribution, and I'm sure it will be put to excellent use in the preservation of the environment. Bob, here's your hat.

Bob Wyman: Thank you very much, Dave. And here's your 'Power Smart' hat. Let's put these things on. I think it's too tight, isn't it?

Dave Mercier: Like he said, his is too small.

Bob Wyman: Well, I've been in my job longer than you have, you see.

Dave Mercier: But since it's the taxpayers' money, I'm also going to give Bob Wyman an 'Environment Youth Corps' T-shirt.

Bob Wyman: Thank you very much.

Dave Mercier: Do you have a T-shirt for me?

Bob Wyman: Just a second. Not only do you get a T-shirt, you get a Power Smart T-shirt! Let's see. Is this as good as the one I'm giving you? There you are. A Power Smart T-shirt and an Environment Youth Corps T-shirt.

Dave Mercier: Thank you very much. And as I'm spending the taxpayers' money, I can't give you anything else.

Thanks by Bob Wyman: Good thinking! But we have one more gift for you. Here is a Power Smart light bulb. You can use that in your office.

And now Mr. Mercier, let me respond to your address. Thank you, Mr. Minister. I think I can say that you're probably the only person in this room who's been in the job for a shorter period of time than I have, and the fact that we have all these learned people out here listening to us expound on a subject that they're quite familiar with, I think only emphasizes the importance of your Ministry and the importance of the message that you brought today.

We thank you very much for adding to our deliberations. We've been here for a day and a half and we'll wrap it up this afternoon, but we thank you very much for contributing to our deliberations and we look forward to seeing a lot more of you in the relatively near future as you continue on as British Columbia's new Minister of the Environment.

Thank you very much. Ladies and gentlemen, thank you for your attendance this afternoon.

Einar Field: Ladies and Gentlemen, if I could have your attention for a moment, please.

I have a very pleasant task to perform. Two nights this week we have been entertained by a marvellous group. They are the students of Pearson College of the Pacific, and last evening they gave us such a performance that we want to recognize them in a very special way, so we have invited the choir director, Edgar Samuel, and Pearson College director Angus Matthews, to accept a gift from B.C. Hydro and the Province of British Columbia as a token of our appreciation.

So I'll ask those two gentlemen to come up

with their student representatives. First, I'd like to give a cheque to Mr. Matthews, and thank him very much. The cheque is for $1000, which I'm sure will be put to good use for the College. Our thanks for a job well done last night and the night before.

Angus Matthews: Thank you very much indeed. We really appreciate this contribution. I have to say that I think my students actually enjoy performing, and therefore it was no great burden to them to come and entertain you last night. In fact, all of our students come to Pearson College on scholarships, so this gift is particularly appreciated. Thank you very much indeed.

Einar Field: And now I'd like to present a print by the Tofino artist Mark Hobson to Edgar Samuel, particularly for last night's performance, which we all enjoyed a great deal.

Ladies and gentlemen, that concludes our luncheon program. We'll reconvene the session in the theatre downstairs at two o'clock.

REVIEW AND DISCUSSION OF ISSUES

The Changing Public Attitudes to Education

Michael J. Kirby

Vice–President, Goldfarb Consultants Limited, Toronto

Einar Field

Good afternoon, ladies and gentlemen. I'd like to welcome you to our final afternoon of this year's Forum.

Our first speaker this afternoon has come from Ottawa to talk to us today. He is Senator Michael Kirby.

Michael Kirby is Vice-President of Goldfarb Consultants Limited in Toronto, a Senator in the Parliament of Canada, a member of the Trilateral Commission of the Club of Rome and a director of several companies. Senator Kirby holds a Doctorate in Applied Mathematics from Northwestern University. Prior to entering public life, Senator Kirby taught at Dalhousie University, the University of Chicago and the University of Kent. He has been Assistant Principal Secretary to the Prime Minister, Chairman of the Task Force on Atlantic Fisheries, Secretary to the Cabinet for Provincial-Federal Relations and Senior Corporate Vice President of Canadian National Railways.

Ladies and Gentlemen, please join me in welcoming Senator Michael Kirby.

The Changing Public Attitude to Education

For the next few minutes, I would like to talk to you about public attitudes and behaviour toward electricity conservation and the efficient use of electricity, and the role which educational institutions, governments and electric utilities can play in changing these public attitudes and their associated behaviour.

My comments today are based on the results of a number of studies which Goldfarb Consultants has done in recent years for a variety of public and private sector clients. These clients have included both government departments and energy companies, particularly electric utilities such as B.C. Hydro and Ontario Hydro.

At the outset, let me clarify my terminology. I will use the terms 'demand management' and 'using electricity efficiently' interchangeably. The public much prefer the familiar term 'using electricity efficiently' to the more technical term 'demand management', but to those who understand both terms they mean essentially the same.

From the public's point of view, however, these two terms are not the same as the term 'electricity conservation.' When people are asked what the term 'electricity conservation' means, in almost equal numbers they give two distinctly different definitions. Half of the population say that electricity conservation means using electricity more efficiently, thereby giving them better value for the money they spend on electricity. The other half of the population says that energy conservation means doing without, and not having the things in life they want. This second meaning of the term 'electricity conservation' has strong negative connotations because it suggests that, as a result of conserving electricity, people will have a less comfortable life, one involving less use of the modern conveniences which the public wants.

To put it more simply, to the public, using electricity more efficiently suggests using an energy efficient bulb. Electricity conservation suggests not turning it on. In order to ensure that my remarks are interpreted as focusing on the positive aspects of improving the way the public uses electricity, throughout my remarks today I will

use the term 'using electricity efficiently' rather than the term 'electricity conservation.'

It is also worth noting that the terms 'demand management' and 'electricity conservation' do not necessarily mean the same things to an electric utility. For example, I recently had a meeting with the senior management of a large US electricity utility. During our meeting, we were discussing a variety of issues related to demand management. As the meeting wore on, it became clear to the management of this utility that the terms 'demand management' and 'electricity conservation' mean distinctly different things.

In the lexicon of this utility, the term 'demand management' was reserved for the situation in which a customer was persuaded to manage his/her demand so as to reduce that customer's demand at the time of the utility's peak load. This utility's 'demand management' programs were designed to reduce the utility's system peak load, thereby delaying the need for the utility to add to its generating capacity. Demand management was therefore treated by the utility management as a new source of supply, and the benefits of demand management programs were calculated accordingly.

But the term 'electricity conservation' was used by the utility to refer to customers decreasing their energy consumption off-peak rather than on-peak. The reason this distinction is important is that, as an investor-owned utility, shareholders understood the importance of demand management, and supported it because of its potential to delay major new capital investment by the utility by shifting load. On the other hand, shareholders were much less supportive of conservation programs because they would result in a significant decline in revenues for the utility without a corresponding decline in cost, since the marginal cost reduction achieved by not producing an additional kilowatt off-peak (the amount of operating cost the utility would save by not producing an additional kilowatt of off-peak energy) was substantially less than the loss in revenue which the utility incurred as a result of not selling that kilowatt. From the point of view of an investor, therefore, the utility's profit per share would decline as a result of successful conservation programs, whereas the same would not be true for successful demand management programs.

I introduce this example at the beginning of my remarks today because I think it is important for all of us to understand that the desirability of 'electricity conservation' may depend on the perspective from which one views the issue.

I realize, of course, that one can argue that had the utility done its accounting from a societal perspective, rather than merely from the perspective of the company's financial statement, then the benefits to society as a whole from a successful electricity conservation program might well be greater than the costs which that program imposes on society. While this may or may not be true depending on how these societal costs are calculated, what is true is that balance sheets, stock markets, annual reports and shareholders do not take these costs into account when they are assessing a private sector utility's financial performance and deciding whether or not to buy the utility's stock.

Let me make one other preliminary point. It is important to understand the trust and confidence which the public have in their provincial electric utility. Study after study has shown that the trust, confidence and favourability ratings of electric utilities are higher than for any other type of company. This is extremely important, since if this were not the case it would be very difficult, if not impossible, for a utility to successfully undertake the type of steps with respect to teaching the public how to use electricity efficiently, which I believe utilities ought to undertake.

It also makes one wonder why provincial politicians in many provinces think it is politically popular, or advantageous, to attack the provincial electric utility. There is clearly no political advantage at all in doing this given the public image of the utility.

With that background, let me begin by explaining what our research has shown will motivate consumers to use less electricity - to use electricity more efficiently.

There are two motivators: the primary one is money. The consumer can be persuaded to use less electricity if he/she believes that the amount of money which is saved is 'worthwhile.' A few dollars a year is not regarded as 'worthwhile.'

Second, consumers can be persuaded to use less electricity if it is possible to create, in the

consumer's mind, a linkage between his/her use of that electricity and the negative impact which generating that electricity has on the environment.

These two motivators apply to both residential and commercial/ industrial customers of a utility. The financial motivator is by far the stronger of the two motivators. Nevertheless, I have hope that, with a proper positioning, it will be possible to educate consumers about the environmental impact of their use of electricity, and hence motivate them to use electricity more efficiently.

Let me turn now to the question of what the barriers are to consumers opting into demand management or electricity efficiency programs. There are five main barriers.

First, consumers find using less electricity not worth the effort. That is, they find that the 'cost' of inconvenience is significantly greater than the amount of money they save by using electricity more efficiently. Electricity is regarded as such good value for money, in relation to other household expenses, and using less of it is regarded as such an inconvenience, that consumers are reluctant to use less electricity in order to save only a few dollars.

This problem is compounded by the fact that the rate structure used by many utilities in North America, a rate structure which was designed in the days when utilities were trying to increase demand rather than promote demand management, virtually completely camouflages the market signals associated with using less electricity. This is particularly true for residential customers.

Let me explain. In study after study, when residential electricity users are asked if they think they could reduce the amount of electricity they use, somewhere between 60 and 75 percent say that they could. When the same respondents are asked whether they think that a reduction would result in a noticeable saving on their electricity bill, fewer than half of them believe that they would notice any saving as a result of using less electricity.

When this question is explored in depth in focus groups, respondents say that it seems that no matter how much electricity they try to save, this saving of electricity is not noticeably reflected in their bill. They say this because virtually every respondent in a focus group will have an anecdote which describes a situation in which they claim to have dramatically reduced their electricity, but have seen their next bill change very little, if at all.

For example, a woman in a recent focus group told me that until two years ago she had three children living at home. Within a matter of months, all three children moved out because they had gone to work in another city or had gone away to study at university. Yet, when that woman compared her electricity bill for the ensuing six months with the electricity bills she had paid during an identical six month period when her three children were living at home, she noticed very little difference. This woman believed that, since the children had left home, she was using a lot less electricity. So she expected that her electricity bill would decline dramatically.

There are of course several reasons why her bill might not have declined. For example, there could have been a rate increase in between the two six month periods the respondent was comparing. Or the respondent and her husband could be using just as many lights even though the children are not at home because they are used to a well lit home in the evening. And obviously, electrical heating or air conditioning costs would not change as a result of two people living in a home rather than five people living in the same home. Thus I am confident that the utility could easily explain to this woman why her electricity bill did not, indeed should not, go down significantly just because three children leave home, and this explanation would be valid.

But that is really beside the point. Because the point is that this lady now believes that no matter how much she tries to reduce her consumption of electricity, her bill will remain virtually unaffected. This is her perception. And people make decisions on the basis of their perceptions, even if those perceptions do not conform with reality.

Moreover, this lady's experience is not unique. I have done enough focus groups with electricity users across this country to know that the conclusion this lady has drawn between the efficient use of electricity and the size of her electricity bill is held by a majority of Canadians.

Given this fact, and given the fact that money is the strongest single motivator for persuading people to use less electricity, those who want to

promote the more efficient use of electricity by residential consumers should ask themselves how they can deal with the problem I have just described. I would like to suggest one answer, although I am certain that people more knowledgeable than I am could suggest others.

Serious consideration should be given to running a pilot project in a community in which the rate structure is a flat rate structure. That is, instead of the declining step function now used by many utilities, a rate structure should be used in which every kilowatt–hour costs exactly the same.

While I understand the logic behind the current declining block rate structure which many utilities use, a structure in which the first block contains a fixed charge for being connected to the network plus a per kilowatt energy charge, whereas subsequent blocks contain only a per kilowatt energy charge, I think it would be very helpful to determine the extent to which the efficient use of electricity could be motivated if a much stronger market signal was introduced into the pricing mechanism. In the absence of such a signal, I fail to understand how utilities will be able to convince consumers that using less electricity will in fact save them enough money to make the effort worthwhile. That is, to convince consumers that the money saved is worth more than the cost of the inconvenience involved in using less electricity.

I should add parenthetically that one could also consider a rate structure in which the per kilowatt energy charge increased from block to block. The problem with this rate structure is that it implies that using more electricity is wrong, even sinful. Whereas what one really wants is a rate structure which imposes a penalty on consumers who use electricity inefficiently, even if they only use a little, and rewards consumers who use electricity efficiently even if they use a lot. It may be possible to design such a rate structure, although I do not know that it is.

This brings me to the second barrier which must be overcome if demand management programs are to be successful, the barrier of inconvenience. The value structure of the average Canadian is such that it places a very high value on the conveniences of life which electricity makes possible. Television sets, microwaves, air conditioning and so on are regarded as essentials of Canadian life. They are no longer regarded as luxuries. If using electricity more efficiently means using less of these things, it would be extremely difficult to persuade Canadians to do so. Electricity is just too valuable a part of the life of the average Canadian for him/her to consider using less of these conveniences just to save a few dollars, even assuming, of course, that the market signals I referred to a moment ago are put in place.

In short, to the average Canadian, electricity conservation is seen as much more of a lifestyle issue than a conservation issue, and most Canadians do not want to change their lifestyle. The challenge to electricity conservation is to persuade Canadians that they can change the way they use electricity without giving up the things in life they most enjoy.

It is for this reason that by far the most successful residential demand management programs are those which involve such things as improving the insulation in a home, replacing an energy inefficient refrigerator with an energy efficient one, fine tuning an electric furnace to make it operate more efficiently, replacing energy inefficient motors or showerheads with efficient ones, and so on. Every one of these measures has the great advantage that they do not require any behavioural change, or lifestyle change, on the part of the consumer.

While it is true that these measures may involve the consumer spending a few dollars initially, the consumer rationalizes the expenditure on the ground that, over time, he or she will get his or her money back with resulting savings in his or her electricity bill. While the average consumer does not understand the technical term 'payback period', nor does he or she know how to calculate it, the average consumer does have a strong intuitive understanding of the notion that, for example, improving home insulation results in savings in energy dollars every year thereafter and hence is worth doing.

On the other hand, it is not at all clear how a consumer will react in the long term to a utility sponsored program which, for example, offers energy efficient light bulbs at a significantly reduced cost to the consumer. While many consumers will take advantage of such a program while it is being offered because they believe it will save them money in the short term, as the recent program in Ontario illustrates, it is not at all

clear how many consumers will continue to buy energy efficient light bulbs, at a higher price than ordinary light bulbs, once the energy efficient one, which they have been given free or at a very cheap cost by the utility, has burned out.

In short, with respect to energy efficient light bulbs, there are no data that I have seen which would enable us to conclude that such utility sponsored light bulb programs will result in an ongoing behavioural, or purchase behaviour, change, rather than merely a one-shot change. Yet surely the real goal of demand management programs must be to persuade consumers to modify their behaviour on an ongoing basis, rather than merely having them respond positively to one-shot 'deals.'

The importance of the lack of inconvenience factor associated with successful energy efficiency programs cannot be over-estimated. All the data I have seen suggest that consumers are not prepared to be significantly inconvenienced, or to significantly change their lifestyle, in order to use electricity more efficiently.

The third barrier to electricity efficiency is the belief on the part of a large number of both commercial and residential customers that they are already doing as much as they can to reduce the amount of electricity they use. A large percentage of consumers - well over half - believe that there is nothing more that they can do.

One of the reasons why I am a strong proponent of in-home or in-plant energy audits is that the auditor is able to show the consumer, even those consumers who now claim that they are doing everything they can to use electricity efficiently, that there are other things they can do to reduce their consumption. Inevitably, the energy audit results in home owner or plant operator undertaking other measures, measures which he or she had never thought of, to reduce his or her consumption of electricity.

The success of in-home or in-plant audit programs is further aided by the personal contact which the consumer has with the person doing the audit. This personal interaction is a very important component of any successful audit program. This is why programs involving in-home audits work significantly better than those in which an individual is asked to respond to a mail questionnaire and then, on the basis of analyzing the responses in the questionnaire, the electric utility writes back to the consumer and suggests ways in which the consumer could use less electricity. While in-home audits are much more expensive than mail audits, it is my belief that they are significantly more effective - probably even more cost effective, although I do not have hard data to prove this point.

It is also important that utilities follow up on their energy audits to see what the customer has done with respect to the recommendations of the audit. We need to understand better than we do now which types of actions consumers are willing to take as a result of an audit, and why.

The fourth barrier electricity efficiency programs face is the widespread, indeed, almost universal belief that the electric utility has an abundant supply of electricity. The public believes that an abundant supply exists for two reasons. First, they believe that the utility would not be exporting electricity, to the United States if it were at all concerned about supply. This belief exists even in Ontario, which is a net importer of electricity from the United States, because the public in Ontario, as elsewhere in the country, think that their provincial utility exports large amounts of power to the US.

Second, the public see large office buildings with their lights on all night, and conclude that therefore supply must not be a problem. This prompts residential consumers to say to themselves: "Why should I conserve electricity when commercial and industrial customers are wasting electricity?"

Indeed, one of the greatest challenges facing utilities is convincing the public of the need for new generating capacity with sufficient lead time that the capacity can be built and come on stream by the time the power is actually needed.

Because of the length of time it takes to build a new generating station, utilities across North America are caught in the dilemma of asking the public to approve the building of a new generating station, with its associated environmental problems, years before the output from the station is needed. Yet if approval is not granted, and if shortages actually occur in the future, it is the utility, not the regulator nor the government which denied the utility the construction approval it requested, which will be blamed for the short-

age. Thus, the risk, if government mandated conservation programs fail to meet their targets, is borne by the utility rather than by those who mandated the conservation targets.

This risk is particularly great because of the difficulty of forecasting accurately the energy savings which will result from demand management programs. It is extremely difficult to predict how such programs will impact on the lifestyle and behaviour patterns of the average citizen, and hence what the resulting energy savings will be.

The fifth barrier to conservation is the inability of consumers to make a link in their mind between their electricity usage and the impact on the environment which generating that electricity causes. While people understand the linkage intellectually when it is explained to them, they refuse to take ownership of the issue. Consumers regard the environmental problems of generating electricity as the responsibility of the utility, not the responsibility of electricity consumers.

In part residential consumers refuse to take ownership of this issue because they want to continue to use electricity in order to avoid being inconvenienced, and in part because they believe that no matter how much they try to conserve on their own, it will have no impact on the environment because the amount of the electricity they use is so small in comparison with the amount used by, for example, large manufacturing or natural resource processing plants. Thus residential consumers do not feel guilty when they use electricity. In fact, even those people who one could describe as environmental activists are reluctant to accept the idea that their actions with respect to electricity use are impacting significantly negatively on the environment.

This problem is compounded by the fact that the only time the average residential consumer really thinks about electricity - if he/she thinks about it at all - is when they turn on a light or turn on electric heating or air conditioning. Consumers virtually never think about the fact that they are consuming electricity when they turn on a television set, open a refrigerator door, turn on a dishwasher or put clothes in an electric dryer. The only top of mind, unaided linkages in a consumer's mind between electricity and its use is through lights and electric heating or air conditioning.

Yet there is a lot of public attitude data which suggests that if a strong linkage could be made in the consumer's mind between electricity consumption and the impact which generating that electricity has on the environment, it would be a strong motivator in persuading the public to use electricity more efficiently. The challenge is to find ways of making this linkage effectively. To date, I know of no utility which has done this successfully in North America, although personally I believe that it should be possible to find a way of making this linkage effective.

If the five barriers I have just described are indeed the barriers to greater public acceptance of demand management or energy efficiency programs, one might well ask why blue box recycling programs have been so successful in Canada. In other words, why is it that the blue box program has worked with consumers with whom energy efficiency programs have not been nearly as successful.

To answer this question, and to show why comparisons between a blue box program and a demand management program are not appropriate, let me explain what focus groups have told me motivates them to participate in a blue box, curb-side recycling program.

First, consumers believe that their individual action can have an impact on the amount of garbage going to the town dump, and therefore on the issue of when a new dump will be needed. Since in many parts of Canada a search for a new dump site is going on amidst a highly charged political atmosphere in which nobody wants the new dump anywhere near their house, the linkage between the garbage an individual puts out of his/her house, and the environmental problem created by the need for a new dump site, is much more established in the consumer's mind than the linkage between electricity consumption and the environment. In other words, an individual consumer recognizes the problem which his/her garbage causes, is prepared to take ownership of it, and believes that he/she can have an impact on the problem by reducing the amount of garbage which he/she sends to the dump.

Second, recycling is not inconvenient. People do not seem to find it awkward to separate their garbage at its source. The inconvenience barrier is much greater with respect to electricity efficiency than it is with garbage recycling.

Third, there is significant peer group pressure to use the blue box, curb-side recycling program when your neighbours are using it. Because recycling has become regarded as "a good thing", respondents in focus groups say they would be embarrassed if they did not participate in doing their bit for society when all their neighbours are doing it. The importance of peer group pressure should not be under-estimated.

There is no equivalent peer group pressure with respect to electricity efficiency. No one knows how much electricity their neighbour is using or not using. Nor do they know how efficient their neighbour is being with respect to electricity usage.

Fourth, and finally, the blue box program works because people feel good about it. They feel that they are taking personal action with respect to improving the environment — and the environment continues to be one of the top three public issues on the mind of the average Canadian. Thus the blue box program is seen in consumers' eyes as one small step for them, but one large step for the environment. Again, energy efficiency programs do not have the same effect because of the failure of the consumer to link his/her use of electricity with the impact that use has on the environment.

It is therefore impossible, in my view, to design an energy efficiency program which has the features of the blue box program in terms of a lack of inconvenience, a strong linkage to the environment and peer group pressure. I believe therefore that constantly using the blue box program as an analogy to claim that demand management programs ought to be equally successful for the same reasons is not a valid argument. While there are very valid arguments for demand management, the success of the blue box program is not one of them.

What then do these observations I have made about the motivators and barriers to electricity conservation, and efficient electricity usage, have to do with education? What they have to do with education is this: what is missing with respect to demand management is the acceptance by Canadians of the value or benefit to society of their using electricity efficiently. In the absence of individual Canadians accepting this value, demand management programs which result in ongoing behavioural and attitudinal change, rather than programs which result in a single capital investment of the types I described earlier being made, are almost certain to have only limited impact.

I believe that there is a significant role for the school system, particularly the public school system, in teaching children about the linkage between electricity usage and the environment. Only through this type of education process will the value of electricity conservation become an integral part of the value structure of Canadians.

Clearly, such programs can be successful. To see this, one only needs to look at the enormous impact which current public education programs about the environment are having on school aged children. Anyone who has talked recently to children in Grades four and up realizes that environmental awareness and environmental concerns are being built strongly into the value structure of the next generation of Canadians. Public school education programs with respect to the environment need to be expanded to include the importance of using electricity efficiently as part of this value building process. In fact, a program to do this has just been developed by the Arizona Public Service Commission.

There is also a role for universities with respect to efficient electricity usage. I believe that this role involves undertaking social science research into understanding what, other than market signals, can be used to motivate ongoing electricity efficient behaviour on the part of Canadians. At the present moment, we know relatively little about how to motivate such behaviour. We also know very little about how to measure, or monitor, such behaviour in demand management pilot programs.

While electric utilities across the country make forecasts of the amount of energy which will be saved as a result of their demand management programs, and while these forecasts are quite accurate with respect to commercial/industrial consumption because the utility is able to monitor closely the number of, for example, energy efficient motors which are used to replace existing inefficient ones, I know of no work which is being done at the present time to monitor behavioural change with respect to residential consumers. Yet it seems to me that some experimental research programs, even though I recognize they will be leading edge research programs, are needed, and that such programs could well

involve both the academic community, as well as private sector researchers in their design.

I believe that it would be in the interest of electric utilities to support such experimental research programs. It seems inevitable that some time in the next few years regulators will start asking utilities to justify, in cost-benefit terms, the amount of money they are spending on demand management programs, particularly those aimed at the residential sector. After all, one of the roles of most energy regulatory bodies is to decide, or at least to comment on, whether utility expenditures are justified. If a utility were asked today to justify its demand management programs, I do not know how they could objectively, and scientifically, answer the question.

I therefore believe that research in this area is badly needed. We need to understand the costs, benefits and real long-term impact in terms of ongoing behavioural change of various types of demand management programs.

If such research programs are to be developed, consideration should be given to doing so through a collaborative research process, such as the process which has been successfully used in Boston and in California, in which representatives of utilities, governments, consumer advocates, environmental interest groups, universities, private sector research firms, and industry have combined to develop a joint research program on demand management issues.

There is also a role for government in promoting demand management and in helping Canadians to accept the value of demand management. This role is largely a regulatory one, a role which involves setting appropriate regulations which force consumers to use less electricity. Examples would be requiring that only energy efficient refrigerators or energy efficient light bulbs be sold. Repeated studies have shown that public acceptance of such regulatory or legislative changes will be less controversial and much more readily acceptable in Canada than in the United States.

There are several examples from other industries which prove this point. Opposition to the catalytic converter, and hence the introduction of lead-free gas, was virtually nonexistent in Canada compared with significant opposition in the United States outside of California. Canadians have accepted non-smoking regulations much more readily than they have been accepted south of the border. Canadians accepted mandatory seatbelt legislation, air bags on cars and tough drunk driving laws, much more readily than they have been accepted in the United States.

In short, making Canadians change their behaviour by making it against the law for them to do otherwise, and by making it impossible for them to purchase energy inefficient products, should be seriously considered by provincial governments across the country. If provincial politicians were as serious about promoting the efficient use of electricity as many of them claim, they would have taken such action already.

There is one further area in which I think universities and governments need to combine for research purposes. This is to find innovative ways of getting market signals into the electricity pricing mechanism. Earlier in my remarks I suggested one way would be to change the current electricity rate structure. I am sure that there must be other ways of doing this. Indeed, I would think this is a very appropriate area for research for both economics departments and business school faculty members, and governments should be willing to allow pilot projects to see how various groups of consumers would respond to innovative, and more market signal driven, rate structures.

University researchers should also ask whether there are ways, other than through the rate structure, to give consumers direct feedback with respect to the amount of electricity they are using, so that the consumer experiences a clear benefit from consuming less, or alternatively a noticeable cost from consuming more, electricity.

In summary, the challenge which electricity conservation and electricity efficiency poses to utilities, to governments and to the education system is a challenge based on the need to instill in the next generation of Canadians the importance of the value of electricity efficiency, its value to society as a whole and its value to the individual consumer as well, and the need to make the consequences of using electricity in both money terms and environmental terms, clear to consumers.

Einar Field: I have a question for Mr. Kirby from the audience. It's very specific but still generic

I think. How can the residential customers become aware of energy savings and cost of electricity rates and consumption rates if the information is not disclosed by B.C. Hydro?

Michael Kirby: That's an interesting question. I didn't know that because I've never actually seen a B.C. Hydro bill. I do know that other utilities in Canada, and indeed elsewhere in the United States, are in the process of changing their bill format so that certain pieces of information are on it, such as: what the price per kilowatt is; how many kilowatts were actually used; and in particular how this year's bill compares with last year's bill in terms of total energy used. In Ontario, for example, their new bill format will enable a consumer to look at his bill and say, "My goodness, I'm using a lot more electricity or a lot less electricity than I was a year ago." Consumers have told us that they find that information very helpful because if things suddenly get completely out of whack, they are able to understand it and begin to take action on it.

So again, that is the very least in terms of feedback that the consumer needs to get, if we're going to get market signals into the system.

Einar Field: I have to admit that I haven't looked at my Hydro bill lately, but I thought the consumption during the billing period was shown on the bill. But maybe it doesn't show the consumption last year during the same period.

The next question is: Why is it always the responsibility of schools and ultimately the teachers to do the type of education that you are suggesting?

Michael Kirby: Well, I would be delighted if you could get parents to do the type of value changing I've talked about. I guess as a parent myself, with five children, I've come to the conclusion that it's much, much easier to change the values of children in grades three, four and five than it is to change the values of people once they become parents with children in grades three, four and five. And indeed, I think smoking is an interesting example. If one looks at the impact which children have had on persuading their parents not to smoke, or indeed if one looks at the impact which drinking and driving programs have had on teenagers, it is very clear from a lot of research that the impact on parents was generated much more by the children teaching the parents to change their values than it was by the parents teaching their children to change their values.

I am not really trying to lay a burden on the education system. But I think I recognize the reality that it's much easier to instill values at the beginning than it is to change them once they're firmly entrenched.

Einar Field: Senior citizens have been frugal all their lives and turn off lights because it's a waste. Fact or fiction?

Michael Kirby: If you talk to people who were adults during the War and who understood the shortage issue that existed then, not only with respect to electricity but with respect to a number of other things, you find that they tend to be more frugal than others. But there's a huge gap between older people who were frugal during the War and therefore continue to be frugal, and a lot of people who have recently become senior citizens. I think, that in any event, even if it were true for people who were senior citizens today, it will be less true when people of my generation become senior citizens because we don't have the values which that war imposed on people.

Einar Field: Thank you. Senator Kirby will be back with us later this afternoon for an additional part of the program, and he'll have an opportunity to answer your further questions then.

But now I'd like to thank him very much for his address to us this afternoon. Senator Kirby, obviously your frequent involvement with public surveys and polls gives you a very direct pipeline to our customers and your insight into their motivations and opinions is very much valued. Thank you very much.

Report from the Student Discussion Groups

Chris Kask

Student, Victoria High School

Introduction of Chris Kask by Einar Field

While this Forum has been going on for the last two and a half days, there has been another Forum going on, as well. There's been a parallel student group meeting, in the Crystal Ballroom of the Empress Hotel next door. This is a meeting of about 100 Grades 11 and 12 students from south Vancouver Island, and they have been discussing the same issues we have, and particularly the Partners in Education initiative.

Chris Kask, a Grade 12 student from Victoria, has agreed to act as the spokesman for these students, and he's going to give our Forum a brief summary of their findings. The feedback I have from their group is that they have some wonderful ideas that we certainly want to take into consideration in our future plans.

So Chris, it's your turn.

Report from the Student Discussion Groups

Thank you.

Let me just explain first that I just found out this morning that I was going to be up here, so excuse me if I stumble a little bit.

Basically, what we did this morning was to form several groups. But we didn't stay with the people we came with from our school, we mixed up our groups, and we discussed the questions that we were given. The main topic was what to do for education, to educate people better in the use of electricity.

Each group came up with their own ideas on what they thought was important and although there were, I suppose, ten groups, each group came up with basically the same thing and that was conservation. Conservation was the main thing for everybody.

Now, I should explain to you that we also had a session yesterday afternoon on career choices. From B.C. Hydro we had a dispatcher talk to us. He mentioned about the lack of females in his area and also he talked to us about 'apprenticing.'

There was an important talk on education, on goals, on future plans, and the importance of high school and post-secondary achievement, which was very helpful to all of us, I think, and emphasized how important our education is to us now. There was also a talk on engineering, and careers in engineering and its challenge. That was the session yesterday.

For this morning's session, discussing B.C. Hydro's problem about how to get people to try to conserve was very worthwhile. It was not just for students but it was also for the B.C. Hydro people. I, and others, agreed that it was important to get students involved, because we have a lot of ideas that should be heard.

We were asked if we should plan to do this again next year, or maybe if you should plan to invite us for next year and I think there was a resounding yes, because it worked very well.

There were a lot of good ideas coming out of our discussion groups this morning, the sorts of ideas that don't come out when you're meeting in committees. 'Group work' works. Getting student ideas is great.

Okay, now some of the ideas that we actually came up with; everyone thought of conservation.

Not only can we help the environment through conservation, but also by not constructing more dams. Other ideas were to use education in the education system, and in the workplace, in government and for the public.

We thought that the current B.C. Hydro Power Smart program seems to be working very well because everybody knows what it is, you see it all the time, and that's one of the keys, mass advertising. Now, as for schools; I just heard Senator Kirby talking here, and I think what he was saying is very relevant. You have to start early and young and that's where you put the ideas into their heads to save electric energy. The kids will take it home, definitely.

You have the little stickers that you are given in Grade 3 that you put on your lights to say "Turn me off." I think they work very well.

Also there was the idea of forming a network of students to spread good ideas. Once you get the idea of energy conservation into the school system, it'll branch out and spread to parents, as you mentioned, and to other students.

There was also the idea of individual responsibility, that it's everybody's responsibility to conserve. Some of the ideas for advertising that came up were to scare people, to, you know, mention what happens when you leave your lights on all the time, what happens is they're going to have to build another dam.

If people realize what goes on and what has to happen to bring them all this energy then maybe they'll conserve a little bit more, maybe they'll see it's relevant to turn off those lights.

Now, one idea which came up, very surprisingly, in almost every group was the idea of progressive electric rates. A lot of people said that you should get a certain amount of energy per month at regular rates and then after that, the rates skyrocket. It was surprising that everybody came up with this idea, that once people use over a certain amount of electricity, they're really going to pay for the rest.

Some of the slogans that we came up with were quite good. There's some good billboard artwork displayed out there that you should take a look at. How about, 'Conserving energy means conserving your future.' Or 'There is no greater mistake than he who did nothing because he could only do a little.' Words like 'educate' and 'promote' came up often. 'If you abuse it, you lose it.' 'Don't direct the blame, it's everyone's shame.'

Now as I mentioned we made big paper charts to list each group's ideas. They're displayed out in the foyer and I think that afterwards everybody should go out there and take a look at these charts, to get more of an idea of what we discussed, rather than just listen to my summary.

Just to close, I'd like to say that we never know what the future holds; but together, with all our ideas and all our cooperation, the public and British Columbia and B.C. Hydro; we can work together for the health of B.C., for the environment, and for our planet.

Thank you.

Einar Field: Chris, I think I'd like to hire you! Very well done indeed. Thank you for your excellent summary. You and your fellow students do have some very good ideas and we will welcome all of you back here next year, don't you worry. Thanks very much.

I will ask Jim Savage to come back, come over here and report back on the discussion groups.

Jim Savage: Thank you, Einar. By the way, if you're wondering who I am, I'm a contractor hired by B.C. Hydro to help organize the discussion groups we held yesterday afternoon and this morning.

I'm supposed to summarize four and a half hours of discussion by over 100 people and I don't think that I'm going to be able to do justice to all the ideas put forward. But I will try to move fairly quickly, so that if Einar will permit, we'll have a chance later to open up the floor for discussion and comment briefly.

What I'm going to try to do is reflect back some of the flavours of the discussions. I apologize if I'm a little inaccurate in how I phrase the comments, because it's going through my filter and various other people's filters. I'd really like those of you who want to set me straight on something to feel free to come forward and do that; I think that's very important.

This is the third B.C. Hydro Electric Energy

Forum at which there have been discussion groups and these groups have been handled differently each year, for a variety of reasons, as B.C. Hydro has tried to improve their format. This year, there's been more attention paid to objectives, and perhaps a sharper focus. We wanted to turn people loose on a specific problem to see how that would work.

The problem that was put to you was: 'As it becomes more difficult to obtain energy savings through current promotion efforts, B.C. Hydro needs to develop new types of education programs. What would these new programs look like, who should they be directed at, who should be involved in delivering them?'

We stated an assumption: that improving the energy efficient use of electricity provides environmental and economic benefits. I don't think that anybody challenged that. The objectives were to define energy education, identify possible messages and delivery methods for energy education and identify possible barriers to energy education and courses of action, especially for B.C. Hydro.

Some groups began by defining, sensibly enough, what they meant by education and how it best occurs. Energy education needs to start with a cultural prescription, or maybe I should say a performance standard. We need a 'vision of sustainability.' I should point out that today's discussions were not intended to be a consensus decision-making process. The comments I'm passing back to you were not agreed to absolutely by everybody, so please keep that in mind.

To some, energy education is just motherhood, but to others it's a matter of global survival. Some feel that part of this visioning process is agreeing upon a shared understanding of what ethical changes are needed; an understanding of differences between 'needs and greeds', as one person put it.

The objective of this education should be, and this is good sound educational pedagogy, I think, to develop awareness, understanding and ethical attitudes and skills; in short, the empowerment of individuals to create action. This process of understanding should be continuous, lifelong.

A number of education techniques were discussed, and these included role modelling, learning by doing, various types of hands-on information, and so forth. But access to credible information from a variety of sources with integrity was considered fundamental to the process of informed decision making and education by most groups. That came through very strongly. It was repeated over and over again in the groups.

As far as the content goes, people felt that the history and role of energy, its context in industrial society, the relationship between consumption and lifestyle, technical information on energy sources and uses, and the ecological basis for energy flows in the world was a very important thing to try and get across.

The political economy of energy needs to be explored in this education process. This should include information on the benefits and costs of the existing energy system and of alternatives or modifications to that system. This should be in terms of dollars, social effects and environmental impacts.

Finally, hands-on information: how do we actually change things in our own homes and communities if we want to? The desired outcome was felt to be an understanding of the energy continuum from the source to end services, an appreciation of the electricity content of human activities from the source to the light switch.

I should also say that I'm stringing together phrases that, for the most part, people used in their group discussions here at the Forum.

This is a feedback process, which helps individuals to understand that all electricity benefits carry costs, that there are different risks to different energy choices, and that there is no such thing as an action that has no impacts. This returns us to the beginning, to the process of education, without proper information and feedback on the effects of our actions, how can we change our behaviour? Energy pricing is a direct and powerful form of feedback, but for deeper change, some people feel it will be necessary to develop an equally powerful way of giving people feedback in other ways about their actions.

Now, the next part that I'll do will be a bit snappier, and will give you answers to questions like, 'Who should be involved in promoting energy education?', 'What groups in society need to be educated most?' and so forth, so I'll try and

move through this fairly quickly.

These are ranked points in the sense that out of a long list of ideas that people generated, these are the ones that people felt were most important. They ultimately didn't achieve a one, two, three kind of ranking, despite our efforts.

So who should be involved in promoting energy education?

- Educators, politicians and governments at all levels, including the Ministry of Environment, the Ministry of Energy, Mines and Petroleum Resources and the Ministry of Education in British Columbia;
- Energy utilities;
- Individual consumers at home and at work;
- Environmental and other public-interest groups;
- Large and small businesses;
- Media.

What groups in society need to be educated most?

- Young people;
- Businesses, large and small but especially heavy energy users;
- Politicians and governments at all levels;
- Educators;
- Media;
- Individual consumers at home and work.

For each of the top five targets for energy education what are the most effective messages for each?

- For young people, first of all, tell them how electricity is produced. They can be role models. Their input is important and they can be involved in the decision-making process. They have important choices to make. You and your bicycles are models of wise energy use, keep on rolling. The efficient use of energy can save money and the environment. The smart use of energy means that it becomes a way of life. The more you learn the better choices you can make.
- For Government policy makers: energy efficient standards are essential. Long-range planning is essential even at the expense of short-term costs. Be role models. Energy cannot be forgotten or taken for granted. The public is interested in conservation and efficiency, and so should the government. 'The planet is in crisis', is the message to government. Encourage development of non-polluting renewable energy. Recognize the limits to growth. Do more with less.
- Introduce strong regulatory standards. Provide economic incentives and disincentives. Recognize social and environmental costs. Create energy efficient demonstration models and projects. Hold public forums and workshops.
- For the media, there is a need to focus on proven knowledge as opposed to reporting raw data. Don't get hung up on sensationalism in reporting. Learn as much as you can about energy conservation so that you can report on it objectively. Ensure balanced reporting on all information and arrangements because it's vital for informed decision making.
- Consumers, this includes industrial, commercial and residential: understand the link between earth as our energy provider and energy consumption. Energy-efficient choices are available to you. Expand the payback equation to include social costing. Consuming is not an end in itself. An economy driven by consumption cannot sustain itself.
- Conservation: there are benefits to the environment by conserving. Energy supply is finite and all supply options have trade-offs.
- For industry: how efficient use of energy can save them money and make them more competitive. Again, repetition of the concepts of benefits to the environment by conserving, the trade-offs between different supply options and so forth.
- For product manufacturers: there is a demand for energy-efficient products. Take a leadership role and don't wait to be forced into energy-efficient design adaptation. Energy efficient products don't have to be ugly or special. Use your imagination.
- Finally, educators: be role models. Get parents and families involved. Discuss energy and other subject areas besides the science lab. Target education early in life. Focus on 'less' being better than 'more.' Develop, research, and publicize non-polluting, renewable technology. Recognize limits to growth. Align curricula between subjects. Develop resource materials and teaching aids.

Now, we felt that it was very important to reflect back to you the evaluation which was done this year. I don't believe that an evaluation of the actual discussion groups was done in previous years. Before I get into that I'd like to say that volunteer facilitators were used this year and the candidates for this job were chosen more or less at random. This resulted in a mix of backgrounds. Some were from the environmental movement, some from business, a few from Hydro and government and a few teachers. In addition to all of these people, a number of other people, mostly B.C. Hydro personnel, volunteered to be recorders for these groups and I'd like to thank all of these people for their very generous contribution to the process.

I'd also like to thank Alan Burr, Jim Bruton, Terry Parsons, Marian Lee, Dave Thompson, Bijou Kartha and Andrew Baker for their very hard work to help this process move along.

Most of you, over 70 percent of you, I'll try and stay away from numbers, felt that it was very important to have some kind of discussion session as part of this annual conference. The great majority of you felt that the relevance of the theme was great, the theme being energy education. Most of you, 70-odd percent, felt that the objectives were very satisfactory.

Unfortunately, about 40 percent of you rated the process that we used as being so-so or poor, but most of you felt that the quality of the discussion in your groups was very good. You had quite mixed feelings about the physical arrangements, the main problem being that we started with more than one group in several of the rooms and that made it difficult to follow what was going on in your own group because of the noise level.

Next the question, 'How would you improve on the discussion group sessions held at this year's Energy Forum?' Now, there are four major points here. These have been summarized from 20 to 30 responses, so please keep that in mind.

- You want information, preparatory information on these discussion groups sooner than you got it this year. This year was the first time that you actually got anything ahead of time but most of you only got it a few days in advance. Most of you would like it even further in advance, which makes sense.
- You want to have only one session, one continuous session broken up perhaps but on one day, early in the day, not at the end of the day when everybody is burned out.
- You want separate rooms for each group. Some of you want smaller groups, some of you want larger groups. Over 95 percent of you want to become further involved in discussing energy education with B.C. Hydro.

Now, as far as the way that you want to get involved in B.C. Hydro as far as energy education goes:

- You want to be involved in an advisory committee, general points about consultation, advisory and steering committees.
- You want to be involved in helping develop printed material. You want to be involved in helping review printed material on energy education. In essence you want some kind of ongoing involvement in this process.

A full report on the discussion groups is going to be put together and sent out. That will include the kind of summary information I've been presenting here plus basically verbatim points from all of the discussion groups. We hope to get that out within a couple of months, instead of nearly a year or so as happened last time, so we want to get that back to you as soon as we possibly can.

Now, I'd like to throw the meeting open to anybody who wants to add something about these groups, correct me on a point, or otherwise liven things up.

Question from the Floor: One of the concerns that I had, and I noticed this mentioned among some of the other environmental groups, was that although focusing the workshops onto only the topic of discussion was good...it was good to be able to focus in on something together, I feel that an opportunity to get more of an exchange and information transfer going on the whole cross-section of Hydro issues, electrical education issues, wasn't available.

The format of the questions seemed to me to be too narrow, so that's one concern that I have.

Einar Field: Thank you.

Jim Savage: Are there some further points or things you feel that weren't brought out that should be done differently next year?

Question from the Floor: There was a lot of discussion in my group about the way that the questions were handled in the plenary sessions. I think that probably spilled over to my dissatisfaction with the process of the discussion groups. It was mentioned that at earlier Forums there was a microphone at the plenary session for people to ask their questions directly to the speakers and that wasn't provided this time. There was this feeling of containment, so that when you came to the discussion groups, you already had a built-up frustration level. I think it took us probably an hour to work through it, although after that, we had a very successful discussion.

But in the final analysis, lack of access to a floor microphone was still a source of irritation.

Einar Field: Thanks for your comments.

Question from the Floor: I think it's important to have a knowledgeable Hydro spokesman in each discussion group. The people in the discussion groups come from a wide variety of backgrounds, and we could improve our understanding about the issues and contribute better to the discussion if our questions could be answered right there at the table.

Einar Field: Thank you.

Question from the Floor: I think it might be appropriate when planning next year's Forum to include a representative from either the B.C. Energy Coalition or the B.C. Environmental Network, to just talk with Hydro as they are developing the program, so that there would be someone from the environmental community involved in planning the next Forum.

Einar Field: We appreciate the comment. Anybody else?

Question from the Floor: I feel that there was not a great diversity of opinion provided in the Forum to discuss all sides of an environmental ethic. When it came to the discussion groups, the questions were contained and directed and I think a lot of frustration developed out of that aspect.

Einar Field: In fact, we had planned to provide an opportunity this afternoon, if time permitted, for an open discussion and questions about the Forum. But our program is very full, and I'm not sure there will be any spare time. Thanks for your comment.

Question from the Floor: Next year, could you spread the discussion groups over the three days and not try and do it all at the very end of a day and try and finish on the following morning? The give and take in the discussion groups seems to me to be the most valuable part of the Forum. It should be given a higher profile.

Jim Savage: I should repeat the question so that everybody can hear it. In effect, you want a longer time for the discussion workshops, they shouldn't be held late in the day, and should be held in three sessions instead of two?

Questioner from the Floor: Yes.

Jim Savage: Thank you.

Question from the Floor: I'm not sure how much the Victoria Chamber of Commerce had to do with setting the dates for the Forum, but when you put it smack in the middle of the week, on Tuesday, Wednesday and Thursday, with travelling on Monday and Friday, it makes it very difficult for those of us who work to get the necessary time off.

Einar Field: We'll change that next year.

Question from the Floor: Are there other plans for processing the discussion information besides us getting a copy of what the results were?

Jim Savage: That's an excellent question. I probably can't answer that to your satisfaction but my understanding is that the Power Smart people have, perhaps, reached a wall using their current promotional methods. This year's discussion topic is a very real problem and the Hydro marketing group is interested in it. They are very interested in exploring new ways of pushing on education and an energy ethic and so forth.

Maybe it would be appropriate to ask a Hydro person to comment on that?

Jack Habart: Maybe I can. I'm Jack Habart, and I'm with Hydro's Power Smart Group. The

answer to the question is 'yes', we're very much looking forward to seeing the information come in from this Forum, to learn what you delegates think we should be doing, and to see what we can incorporate into our marketing plans for the future.

Einar Field: Thank you, Jim. I think we can call a break now for coffee. Could you all plan to meet back here in about 15 minutes, at 3:30 pm.? Thank you.

Panel Discussion

Educational Challenges for the Future

Moderator: Michael Kirby

Vice–President, Goldfarb Consultants, Toronto

Panellists
Norm Gilberstad
Walter Hardwick
Matt Hassen
Milton MacClaren
Marge Qualls

Introduction of Panellists by Einar Field

May I have your attention, please. We'll now begin the last part of the Forum program.

By far the majority of the presentations at this Forum have been focused on education and it's certainly appropriate that the concluding session is a panel discussion on the education challenge for the future.

You met Senator Kirby before; he will be the moderator for the session. Marge Qualls will be one of the panellists; you met her this morning. The rest you have not met but they are listed in your information folder, so very quickly, I'll just go through a brief introduction, and perhaps the people could stand up as I mention their names.

Norm Gilberstad is the Sciences Strand Coordinator at the Curriculum Development Branch of the Ministry of Education.

Walter Hardwick is a Professor of Geography at the University of British Columbia.

Matt Hassen is the Director of Personnel for the Burnaby School District

Milton McClaren is an Associate Professor of Education and an Associate Member of the Faculty of Science at Simon Fraser University.

Just one further point; as you listen to the presentations by the panellists perhaps you could think about the questions you would like to ask and pass them into the aisle and we'll pick them up there.

Over to you, Mr. Kirby.

Education Challenges for the Future

Michael Kirby: Thank you very much, Einar.

The format this afternoon will be that each of the speakers will speak for four or five minutes. We will then take questions either in written form or, in view of the fact that this is the last session; if it expedites matters for individuals to stand up and ask a question, we can do it that way, too. In addition, panel members will be free to comment on what other panel members have said or in response to a question so, that we won't necessarily limit each panel member to a single response to a specific question.

So we'll start off with Marge Qualls, and work our way across the panel. Each, as I say, will speak for four or five minutes, and then we'll have questions from the floor. Marge.

Marge Qualls: Thank you, Michael. First, let me congratulate B.C. Hydro on the public process that you've employed during this conference. I think listening is one of the most important things that we as utilities, and I do represent another utility, can do. Puget Power has had Consumer Panels in place now for eleven years, who tell us how to operate our utility, everything from how to communicate more effectively with customers to what to put in our least-cost plan.

So I feel that the format you've followed at this conference is a good idea that I can take back to my own office. But I hope that B.C. Hydro doesn't let the process stop here. Regarding education, I think another good idea is to have a teacher advisory committee, again a form of listening, and in this case listening to the experts who know how children and youth accept education, advising us on formats and how effective different methods can be.

I think we can go on the assumption that communication is education and education is communication, and the two cannot be separated. I'd really like to have the time to reiterate every word that was spoken by Chris Boatman earlier today, because we cannot continue to speak to all groups of our customers in the same way using the same formats.

In fact, we can't even always use the same language. Gene Wi of the Cambridge Reports Inc. has done a number of studies over the last several years for the Edison Electric Institute, which is the investor-owned electric utilities' national association in the US. Basically what Mr. Wi has learned through many nationwide surveys is that the more we segment customers into individual groups and the more we treat them as individuals when we communicate with them, when we develop programs and services for them, the more they perceive that we as utilities care for them and are concerned about them. That is as important as providing electricity for their needs.

We need to be communicating to the elderly, to our low income customers, to non-English speaking customers, to the Baby Boomers, to employees, to the media, to legislators, to commercial industrial customers, to home owners, to renters; the list goes on and on, as do individuals, as individual targeted groups.

So education isn't just for school kids. My comments this morning were directed mostly in that vein. However, education or communication is for all ages, in all forms. We need to repeat messages over and over again, in different ways, print, visual, audio, etc., etc. There needs to be a lot of variety in relaying the same message, in order for people to remember it, for it to become part of their being.

Finally, as I mentioned this morning, and in my closing remarks, education needs all forms of support from us in business. As I said, it needs money; it needs time, in the form of volunteers; it needs hands-on resources and it needs commitment, from the top down and from the bottom up. Thank you.

Michael Kirby: Thank you, Marge. I'll now ask Norm Gilberstad to make his remarks.

Dr. Norm Gilberstad is the Sciences Strand Coordinator at the Curriculum Development Branch of the Ministry of Education, with responsibility for science and mathematics. Dr. Gilberstad received his doctorate from the University of Oregon in curriculum and instruction with an emphasis on computers in education. He has taught for more than 20 years in public and private schools and has instructed and supervised student teachers.

Please welcome Dr. Gilberstad.

Norm Gilberstad: My introductory remarks will take a few moments. I'd like to talk a bit from the perspective of what we can do for learners, make references to the 'Year 2000', speak of challenges for schools and 'Partners in Education' such as B.C. Hydro. Most of my comments really have to do not so much with the information that we provide but the process by which students can be equipped with the tools to become more functional as educated citizens.

However, when I give these remarks, please take them in the context of energy and environment. In contrast to what we've had in the past in our education system, there is some

contemporary thinking about what education can mean for the youth of British Columbia. I think only a thoughtful approach to the creation of experiences will provide learners with the attitudes, skills and knowledge required to be educated citizens, not only in name, I might add, but also in terms of taking action.

I think we must move from merely *knowing* to truly **understanding** and acting upon that understanding. The Ministry of Education's role in curriculum development, which is where I work, is now shifting, so as to provide school districts and teachers with greater local autonomy and decision-making and therefore greater flexibility in organizing instruction, choosing resources and selecting assessment and evaluation strategies.

The Ministry is providing the curriculum assessment framework for programs at the levels of primary, intermediate and high-school graduation. This framework will likely provide first-level instructional objectives, giving teachers an organizational structure upon which they, together with their students, can build programs of study, exploration and investigation; emphasizing problem posing, decision making, problem solving and critical thinking in the examination of issues.

It is this kind of structure and flexibility that can facilitate teacher development and provide a context for learning. It is this kind of structure that permits the educational community to re-examine what is known and understood about our cultures and traditions and to make decisions about what to emphasize and what to leave in the background, about what to keep and what to let go.

At the same time, this kind of structure permits learners to contribute to the design and substance of their learning by acknowledging their interests, needs, wants, attitudes, skills, prior knowledge and understanding.

This approach can enable community resource people to make a significant contribution to the education of our young people. This approach is **forward thinking.**

I've summarized some of the needs I think that learners need. I think it's always important to keep in mind the client. Learners clearly need more than information and the ability to recall or recognize it. They need to understand holistically what is at issue and where they can go for information. They need methods for assessing it. They need thought processes and skills to be able to discriminate what is useful from what is not.

They need to practise applying appropriate information. They need skills in decision-making and in taking action. Students can benefit from experiences that provide elements of the following: participatory-based activity at the school and community level; challenges to their entrepreneurial and creative spirit; support for any motivation they have towards physics, topics in energy, ecology and the environment; the kinds of questions to ask and opportunities to ask them; knowledge of how they learn best, to know their learning style; mentors in whom they can trust and believe; experiences in the context of real world problems and issues including project work, both individual and group; and the creation of a product; skills needed to be able to access, evaluate and organize knowledge and knowledge structures; and knowledge that there are multiple perspectives and points of view that may inform the decision-making process, for example, those that surround energy conservation and public safety.

In terms of challenges from the perspective of the Ministry of Education the challenge for us lies in its mission statement for the schools of British Columbia. **'The purpose of the education of the school system in British Columbia is to enable learners to develop their individual potential and to acquire the knowledge, skills and attitudes needed to contribute to a healthy society and a prosperous and sustainable economy.'**

There are at least two key implications of this mission statement, the way we educate our future teachers and the way we support 'Year 2000' initiatives at the district and community levels, including types of resources and assessment programs, techniques and strategies.

Aspects of these challenges include engaging learners and teachers who themselves are learners, providing relevant, meaningful and functional experiences for learners, enabling learners to contribute to and support the goals and aspirations of the community, developing in learners the attitude of lifelong learning.

The challenge for B.C. Hydro's educational

programs may well include modelling energy conservation and environmental awareness, participation and commitment with support from government, business and industry, finding alternative or additional ways of helping to pay for educational programs, again with broad community support, developing an energy efficiency attitude in both individuals and corporate groups.

In so far as schools are concerned, school organizational structures can be developed whereby they give learners more responsibility for decision-making in their learning, make allowances for prior knowledge and understanding learners have, provide opportunities for learners to develop the scaffolding upon which they may hang conceptual knowledge and information so as to gain a broader and deeper understanding of a subject, discipline, topic or issue, and to understand themselves better in relation to subject, discipline, topic or issue, give learners opportunities to make connections among information, facts, concepts and principles so the learning experiences are perceived as relevant and meaningful.

Learners need to be able to make sense of their world as they perceive it, and of who they are. Teachers need to feel comfortable in the new role of serving as facilitators, but we must support them along the way with resources of all kinds and professional development activity. Excite learners about their potential contribution in creating a better environment in which to live.

Students' ability to address energy conservation and environment-related issues can be enhanced through 'Year 2000' school-based initiatives such as the following: an intermediate curriculum, and by that I mean what we now consider to be Grades 4 through 10; an intermediate technology curriculum offering greater attention to career education, explicit reference to thinking skills, as, for example, in science education; forms of curricular integration in which learners make connections and identify linkages between topics, issues, themes from more than one subject area at a time; a common curriculum for the graduation program.

We must provide increased contact with the workplace and community resource people, an ecological framework for learning.

Energy conservation for example, must be viewed, studied, explored, investigated and practised in an integrated context such as that of the environment.

Could outdoor education or summer camp programs, for example, provide an appropriate setting for such activity?

In conclusion, I would like to make a short comment about the importance of information and knowledge, lest it be perceived that the Ministry is no longer interested in learners constructing knowledge or utilizing information.

It continues to be an essential need of individuals to have relevant information that will support the alternatives they are being asked to consider for any issues. The choices must be informed. It seems difficult for individuals to be comfortable with choice if there's no supporting rationale for their choice.

If there is excessive electrical energy consumption in Canada, then I as a learner or citizen want to know in specific terms what the excesses are. I want to know the quantitative excess, what kinds of action on my part will make a difference, and by how much. Moreover, it is difficult to translate a small individual excess into meaningful understanding without some models and reference to the bigger picture.

In terms of public safety, we are told that it may be appropriate to avoid the switching transients, or rapid bursts of magnetic energy associated with turning appliances on and off. Well, if we suspect there is an association of transient magnetic fields with a higher incidence of, say, breast cancer, then we need information about the detection of such fields, in the very least. This is an environmental and safety issue.

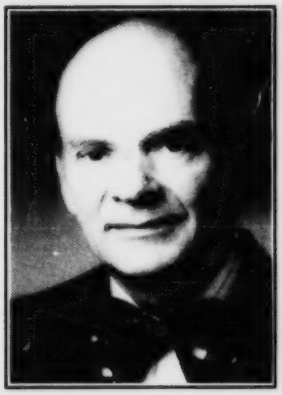
It is not enough to simply make a statement about what to do and what not to do, irrespective of whether the information is documented by research or not.

In conclusion, I'd like to acknowledge B.C. Hydro's thoughtfulness for including education as part of this year's Forum theme and thank you for inviting the Ministry to participate.

Michael Kirby: Thank you Norm. Our next speaker is Walter Hardwick. Walter Hardwick is a professor of geography at the University of

British Columbia, where he teaches courses in urban studies and political and economic geography. Dr. Hardwick is a former Vancouver Alderman. He was Deputy Minister of Education and Science (1976-1980) and the founding Chairman and Chief Executive Officer of the Knowledge Network.

Please welcome Walter Hardwick.



Walter Hardwick: Thanks very much, Mr. Chairman. Most students in our province and the majority of the adult population are in general terms, aware of environmental and conservation issues.

When citizens were polled last year in the Greater Vancouver and Fraser Valley Regions (GVRD) under the planning project, 'Choosing Our Future', environmental issues were rated as critical. Among the top ten issues, only provisions of health care and affordable housing ranked with environmental issues.

The highest environmental concerns were those related to perceived public health issues, such as disposal of hazardous wastes, and water and air pollution. But a very close second were those related to the maintenance and enhancement of the natural environment, which includes rivers, estuaries, flooding behind dams, and mountain forests.

A clear indication of citizens' concerns is that the majority of respondents reported they would be prepared to change their behaviour. Confirming Mr. Kirby's observations about blue box recycling, GVRD respondents answered positively to higher fees, tolls and taxes for programs such as liquid waste management. And some are even prepared to change their residence or ride bikes to lower total aggregate vehicle travel within the region.

Nevertheless, there is still a large minority of respondents who consider environmental and conservation campaigns a bore. And many of the things that are being claimed or asked of them, they see as an infringement on their individual rights and liberties. To these people the 'tragedy of the commons' is beyond their comprehension.

The public's biggest beef is that government and industry have not created enough mechanisms or enough means for them to respond to the environmental and conservation ethic that they profess.

We've heard today about alternate automobile power sources. So far, industry has not delivered. Perhaps Henry Morgan, the gentleman from Los Angeles who spoke here yesterday, is correct in stating that there may be a large enough market there's enough activity in the Los Angeles market; and down there to encourage people to start to change their driving habits. They also have enough information to help them measure change in their consumption patterns.

What Mr. Kirby put on the table today was primarily the question of price. There are other means for people to measure what they are in fact able to do. There is an interesting experimental program entitled "Eco-Feedback' in Europe. It is feedback mechanisms that will allow people to see that they've in fact accomplished something in conservation. The Vancouver Board of Trade is trying to do that with 'The Debt Clock' that they tried to put up on Parliament Hill, or was it the Ottawa airport?

In the European case, the reporting of energy consumption levels within communities on TV and radio, remind people about their patterns of use, and remind them to switch off things. People need to be reminded of these things. The GVRD already put up air quality indicators which supply some information for people to track.

Feedback for the electric utilities can come from all those spinning dials on gas and electric meters at the side of your house that nobody can read or decipher. A suggestion is that some computer devices which will allow people to have nearly instantaneous readings from these meters. This isn't quite a price mechanism but it's another way of recognizing that if people are going to conserve, they're going to have to be able to see and measure what they have accomplished.

The point I want to make as the second part of my comments, is that rather than environmental conservation awareness, as we look into the '90s, our problems are going to be how to do

conserve To create mechanisms by which people are able to see that they are acting responsibly is important. That's going to require some technological changes, as it's going to require that industry and others change technologies. Again, Mr. Kirby's comments on regulation are matters that would underline this particular point of view.

The final comment that I would like to make is about the University, since the other colleagues here are basically from the school systems. I'm very pleased that Mr. Kirby suggested that perhaps Hydro and other utilities could invest in social science research. I was interested that you'd call it 'social science and economics.' I didn't know there was a difference. Many people in B.C. Hydro that are setting discussion problems and identifying questions, are engineers. And so their thrust tends to be more and more towards the question of the basic sciences and engineering.

However, at the University of British Columbia, there is a major program being instituted under the general title of 'Sustainability.' In it there are a whole range of topics that are being looked at. Many of them coming from the traditional science and engineering faculties. Some of them, for example, deal with the questions of ways and means of changing behaviour related to automobile use.

There are also initiatives to try to deal with the question of measurement. And I think that measurement is one of the interesting problems that we face. Because if we are agreed that a sustainability ethic is being accepted by a broader range of population, how are these things to be measured so people can in fact feel that there is some quick response to the actions that they take.

The possibilities of looking at things in terms of 'energetics' is being looked at. This is an attempt to convert all activities that people are engaged in, into energy equivalents. And in this way, comparable measures will be generated for everything from the consumption of energy to the consumption of information. There are technical problems in doing this, but it is obviously an area in which people within the universities, coming from the behavioural and social sciences, can contribute.

So as I look to the 1990s, my three major points are: first, that most people are already sold on some kind of conserver and environmental ethic. Second, that people are looking for ways and means of measuring what they're doing so that in fact they can act on the attitudes that they've already developed. And third, towards sustainability, there is a very significant area for research that a lot of people, particularly in the social and behavioural sciences, would like to have a chance to work on.

Thanks very much.

Michael Kirby: Our fourth speaker will be Milton McClaren. Dr. McClaren is an Associate Professor of Education and an Associate member of the Faculty of Science at Simon Fraser University. Dr. McClaren is currently the resident SFU faculty member at the Kelowna Tele-Learning Centre, a centre for research and development of educational applications for computers among dispersed school districts. He was formerly Dean of the Division of Continuing Education and the Director of the Professional Development Program at SFU. He has also taught at various levels from elementary to post-secondary school. Dr. McClaren is a member of the U. S. Steering Committee of 'Project Wild', a major conservation education program.

In 1987, Dr. McClaren received the Distinguished Service Award from the Association for Educational Media and Technology.

Please join me in welcoming Milton McClaren.

Milton McClaren: I'm going to focus my remarks on the formal educational system, largely in the Kindergarten to Grade 12 level, but also, to some extent, I'll include the university environment. And I'm going to talk a little bit about some of the things we've learned about environmental education programs in terms of teachers' involvement in them.

I should explain to you that I'm a member of the Steering Committee for 'Project Wild' in the United States. I understand our new Minister of the Environment mentioned 'Project Wild' in his speech at noon today. I had to attend another

meeting, so I was unable to hear him. I believe that 'Project Wild' is now the largest conservation education program in the world. It operates in 50 US states and 10 Canadian provinces and has been translated into both French and English and their material is now being translated into several other languages for use, for example, in India.

It's a partnership program because it involves co-operation between government agencies and the school system. I think there are some things that we have learned, that people here would be interested in, and which may be of some value to you.

Let me also say a couple of things about environmental education in general, and energy education in particular, as a part of that. It has to do with whether or not we see environmental education as being an important component of the general educational program in the schools.

At this point in time, I would have to tell you that all environmental education is essentially marginal, and in many cases is simply not officially covered in the existing K to 12 program in the schools of this Province. The course which had the largest component of energy education was Science and Technology 11, a course which has essentially been destroyed and marginalized by the refusal of the university Senates to recognize the course for transfer to the Universities, in spite of the urging of their Presidents that they do so. That course dealt with the social and technological impacts of energy in all of its forms, and its utilization and generation. It has essentially, as I said, been made an ineffective component of the curriculum.

One of the questions that we're struggling with in this Province is whether the educational structures of the 19th century will serve the children of the 21st. My own personal view is that they will not, and that if we treat environmental education as something which is just simply to be tacked on as another useful thing, like driver education, sex education, alcohol and drug abuse, substance abuse and a thousand other things that come walking through the doors of the schools every day, asking for yet another component of time, then we will go nowhere with environmental education.

So the curricular location of environmental education may be seen as part of a broader curriculum which includes such things as global education, education dealing with scientific society and technology issues within a restructured school program. If we see it as trying to add yet another little piece on top of an already jammed and crowded program, then I think we have very little hope that we're going to reach any major segment of the school student body very effectively, particularly in the K to Grade 12 sector. Those may sound like hard things to say, but I think it's absolutely essential that they're understood.

Let me also make a couple of points about the relationship between teachers and agencies such as B.C. Hydro in the development of educational programs. I have for many years, been involved with Federal Government programs in the Department of the Environment in Ottawa, and I've seen warehouses filled with very high quality environmental education program materials, printed on beautiful multi-colour separations, glossy, very well developed, containing very high quality information and most of it has never seen the light of day in terms of actually getting down to where people live and need to use it.

The secret to effective partnerships is in the ownership of the program and the materials in the classroom for teachers who ultimately must use it. There is a need not just to focus on the generation of materials and programs on paper and print or computer disc or whatever else, but of engaging the teaching community in the process of owning them, making them part of their program and wanting to be involved in them.

In the final analysis, if you want an effective partnership, you don't just simply invite teachers to critique material that has been produced by experts or by a handful of teachers. The teachers need to be involved from the outset in the development of the materials themselves.

The people in utilities such as B.C. Hydro have expertise concerning energy which the educational community does not have. But the educational community has expertise concerning the delivery, design of instruction and the nature of the student body that utilities do not have. From the very beginning, that synthesis needs to be made.

We had a very important and powerful experience in the new aquatic supplement to 'Project Wild' by convening five major writing

conferences in five regions of the United States. We brought together the best teachers we could find with the best people in the field of water management that we could find, and we created some absolutely 'dynamite' material with high degrees of ownership right from the beginning. Don't do it after the fact. Don't dump the program on them and then say, 'What do you think about this now that we've got it?' The involvement has to be from the outset.

The second thing to remember is that teachers are human beings and like most human beings, they use things according to some incentives. The biggest incentives for teachers is the sense that somebody cares that they're doing it. If you look into the Salmonid Enhancement Program in Canada, you'll find that it demands that teachers get involved in things like stream rehabilitation and putting incubation boxes in classrooms. There have been some absolutely stunning examples of direct student action in improving the environment and making a real difference to the return of fish to creeks. But it takes years of effort on behalf of teachers and students in order to carry those projects out. Very often we support the teachers like crazy when we first give them the materials and then we sort of fade away. After a few years, the teachers who were doing all this work, getting these incubation boxes and hatcheries, etc., think, "Does anybody care? Does anybody know? Does anybody appreciate all this effort?"

If we want our programs to be effective in terms of schools, we have to develop them, implement them, evaluate them, improve them, renew them, celebrate them, and sustain them. We're very bad at the last three or four phases of that process, but we're very good at generating a lot of up-front material to begin with.

I'd also like to say that we need to understand that complex areas such as energy education require a multi-disciplinary perspective. They require the examination of the problems of energy in all of its forms, from scientific, engineering, social and geographical perspectives. There are a number of different disciplines that need to be involved from an economic perspective.

The traditional school organizational pattern separates and isolates those components from the beginning of high school right through into universities.

It is increasingly being realized that unless we encourage a lot of lateral communication among the disciplines, right from the first time that students begin to have contact with the development of disciplinary knowledge, it is going to be impossible for students to really develop an appropriate global perspective on those problems.

We are fighting an interesting battle in this Province over the concept that we might actually get some of these disciplines to begin to make lateral contact with each other early on in the school process. Horror of all horrors, they might actually start to do such things in the universities too.

I think today if we could only do one thing in all of this, if we were to try to prioritize our groups, my shopping list would say that the first thing that we have to do for the students from K to Grade 12 at least, is to help them develop the capacity for systems thinking. By that, I simply mean that they need to begin to understand that there is no free lunch. That things do not go away. The loop always closes. What seems to produce short term gains in the present may have very major long-term costs in the future. If we could develop that perspective alone in 12 years or 13 years of schooling, we would not only have done a good job in terms of environmental and energy education but we probably would have done a good job in terms of general definitions of education which state that people should be able to evaluate the consequences of their actions and think more carefully about the choices available to them.

In summary, I'd say that the problems of environmental and energy education are inextricably woven together. They represent a very major challenge to the existing way in which schools run. They amount to more than just rearranging the deck chairs or putting a new coat of paint on the classroom doors. Thanks.

Michael Kirby: Thank you, Milton. And our final speaker before we open it up to questions from the floor will be Matt Hassen.

Matt Hassen is Director of Personnel for the Burnaby School District. Dr. Hassen received his PhD from the University of Alberta in education administration. He has been a teacher, department head, Director of Administration with the

B.C. School Trustees' Association, Executive Director of the B.C. Council for Leadership in Education Administration and Regional Director for P.J. Spratt and Associates. In this latter capacity, Dr. Hassen served as a consultant to B.C. Hydro, coordinating the development of the energy education program for schools.

Please welcome Dr. Matt Hassen.

Matt Hassen: Thank you, Mr. Chairman. I think I'm in the 'death slot' because everything that I would have liked to have said has already been said. But that's never deterred me in the past. And so I'll continue.

I guess I bring two perspectives to this panel as far as energy and environment education is concerned and for partnerships to facilitate this.

As some of you know, I had the good fortune to act as an education consultant to B.C. Hydro for a little over six years, developing an energy and conservation education program for schools. More than 50 teacher/advisors from throughout the system were involved in helping to identify what they felt was needed and identify how that kind of material might be developed and put together, invented and tested. We developed three sets of materials. One for primary, one for intermediate and one for secondary schools. Throughout the life of that program, its death knell being the restraint programs of the mid 1980s, some 13,000 sets of materials were distributed upon request, some 4,300 teachers attended in-service workshops that were delivered on-site in locations throughout the Province. And some 1,200 teachers were subscribers to a quarterly newsletter called 'Sources.'

It's a rewarding thought for me that this idea is coming around again, and I would like to congratulate B.C. Hydro for picking up that initiative, because that initiative is indeed necessary.

The other perspective I bring is that I'm a District official and although I'm a Director of Personnel, I am the person who is assigned to the Board's Environment Education Committee, as a staff resource. I'm also the person responsible for coordinating the environmental programs and the recycling programs in our district. In this capacity, I am the recipient of requests, proposals and even propositions from various groups and organizations, on at least a weekly basis, to come in and do something for us.

With those two perspectives, I can identify a couple of challenges that we face in education and as it relates to these issues. They are managing the rapid rate of change we all face and finding new balances.

Although it may not be obvious to all, the school system is constantly undergoing change. But, as Alvin Toffler observed in 'Future Shock', people don't object to change. They're changing constantly. We are all changing constantly. What people object to is being changed against their will.

The education system and the people in it are no different. So what we are looking for is some way of managing the change that's coming at us and finding some new balances. Yesterday, Tazeem Nathoo talked a little about what are, in effect, implied shortcomings of the system. And there are, in fact, shortcomings.

Our current school system is still largely patterned on a traditional industrial model with a production process and a product and that's part of the problem.

As a speaker at a recent conference observed, to some extent our secondary schools can be described as places where the relatively young go to watch the relatively old work. To some extent that is true and valid, and clearly things must change. Schools must become places where students go to work.

The 'Year 2000' document offers us some guidelines and directions in terms of how we might go about moving from the student as product to the student as client or consumer. However, this change will take time and it will not be easy. It will require support from parents, from business and from the community. The school system will likely experience some failures along the way toward finding the new balances. But finding these new balances also means finding ways of welcoming and increasing input and involvement from groups and organizations in

society while at the same time, buffering students and curriculum from fads, from passing crises and from narrowly vested interests. We will also need to find ways, as Norm Gilberstad suggested, of off-loading part of current curriculum that's laid in place in order to make space for some of these other things.

Now, everyone agrees that there are all kinds of things we could drop from the curriculum. The trouble is, there's no agreement on what these specific parts are. So what we face quite frequently is simply add-ons, and again, as Milt McClaren observed, if it's going to be an add-on, it won't get added on at all.

If our partnership with groups such as B.C. Hydro is going to be successful, we're going to need help in terms of striking some of those new balances. Thank you.

Michael Kirby: Thank you very much, Matt. Now, I have a number of questions here, probably far more than we could deal with between now and when this session must end, at about five o'clock. But I'm also happy to ask if there are any questions from the floor: if people would like to stand up and ask the question orally. Is there any question anyone particularly wants to raise or would you prefer that I try to synthesize several of these specific questions I have here? No questions?

Some people have asked some really wonderful questions, and I will try to amalgamate two or three of them together, and I will ask various members of the panel to comment. Norm, maybe I'll ask you to make the first comment on the following question.

Question: A lot of the discussion this afternoon has focused on the use of the education system to instill certain values. Is there a danger of the education system being used as a marketing strategy by industry? And what can be done to protect the integrity, particularly from an environmental perspective, of the information being disseminated? Another side of this issue is the question which asks, 'Given the role which environmental groups, associations have had at this conference, could you suggest ways in which such organizations can be involved in the development of school environmental programs, because that is another way to ensure that the information given to students is not biased.'

Norm Gilberstad: I think the checks and balances in terms of the information itself can be accommodated by having a number of players. Partnerships are something that ensure that there are multiple perspectives in the development of information available to learners and can help describe or characterize the issues before discussion.

The danger is not in the information itself. The danger, it seems to me, is that there is only one kind of information. If you're building curriculum from a teacher's perspective, if learners and teachers are building the curriculum jointly, then they're going to want to accommodate as many points of view as possible.

Michael Kirby: Okay, Milt, do you want to comment on that in light of the experience you've had with the program that's been developed both in the United States and Canada?

Milt McClaren: I think that one of the things that people often tend to do in developing programs, materials and so on for schools, is that they try to avoid controversy. They try to make the programs deliberately very vague or very bland. There's a sense that somehow or another you don't want to confuse people or raise red herrings or whatever. I think that's the wrong approach. I think that people are much better off to make their positions clear right out front, and to say, "This is our particular position on this issue, and you may disagree with it. There are other positions." Acknowledge that there are other positions and state, "This is our position. We've thought about it."

I remember a discussion I had with McDonald's hamburgers about packaging, and I know that you heard Martin Hocking's remarks on the same subject yesterday. But one of the things I remember about McDonald's is that they were very straight up about their position, which was that they had looked into their packaging and container situation and they had made a decision. They were going to stick with styrofoam packaging. They knew people would disagree with them, but they were going to stay with it. They later reversed that decision, by the way, but that was the first position they took. They didn't try to fudge around it, which I, at least, appreciated.

I think we need to be straight-up. If you leave things out of an educational program in the hope

that you won't open cans of worms, I assure you what you leave out will speak as loudly as what you actually put in.

So give kids credit for intelligence and teachers credit for being able to discuss quite sensitive and emotionally-charged issues in ways that you might be quite dazzled and amazed at. I think we tend to hide these things from people and worry too much about whether or not we're going to indoctrinate them. It is something that teachers need to be cautious about.

Michael Kirby: Would any of the other panel members like to comment in addition on that question? Matt?

Matt Hassen: A couple of additional comments perhaps. To set out to develop balanced materials is to set out on a mission looking for the Holy Grail and that hasn't been found either. It's like the notion of truth. You know, truth is somewhat in the eyes of the beholder.

Milt made the observation about the low success rate for educational packages developed in isolation, and then saying to teachers, "Here, what do you think about this?" I think that's one of the reasons why the active involvement of teachers as advisors in the developmental stages can be helpful.

As far as balance is concerned though, the best that one can hope for is to try to put a balanced array of information before students and then ask the testing questions. Give them a series of questions that would cause them to look at pros and cons, what-ifs, that sort of thing.

Where a corporation or an organization can be helpful is if it helps to provide the source of information and to provide the questions, but does not attempt to provide the answers. The answers should come out of the discussion and the instructional process in the classroom.

Walter Hardwick: I would just like to say that this panel seems to be heavily involved in the educational production process. But if you really look at what young people are doing the majority of the time nowadays, they are watching television and rock videos and listening to pop music. Media things of this nature are an enormously powerful means of transmitting cultural values and ideas. If you talk to children about where they are getting messages, some of them may be from individuals like Dr. David Suzuki with his columns and his television broadcasts. Some messages come through the lyrics of pop songs that they listen to morning, noon and night.

So when we want to talk about environmental and energy consumption awareness, let's realize that we are talking about a whole information package that young people as well as the adults at large are getting from all sorts of sources besides the classroom. If we really want to animate people and change people's minds, it's on a very, very broad front not on the narrow front of curricular materials in schools.

Michael Kirby: Thank you, Walter. Here's a logical follow-up question directed to Marge Qualls. Marge, the question essentially is first of all, 'roughly how much money in dollars does your utility now spend on public school education programs' and secondly, 'what would you do if suddenly your utility said to you that you could increase that public school education budget by 25 per cent?' Where would you spend the money?

Marge Qualls: I would say that first of all, at Puget Power we have three people in our educational services staff. We utilize the entire employee base as resources for the classroom so we are able to leverage any monies that we do spend on education a good deal by using that resource. Linemen go into the classes and give presentations, secretaries, engineers, managers, the whole ball of wax.

We have basically a relatively low budget compared to the impact that we are able to make in the schools.

Now, for the second part of the question. If we had twenty-five percent more, where would we spend it? We would start publicizing our school programs. Right now we don't do that because of the huge demand. Schools are basically just like sponges, sponges for information. In some of our small school districts, the only science curriculum is what we, the utility company, provide. Now that is an unusual situation but it is, in fact, true. Schools are always short of money and that's one of the reasons some school districts don't have adequate science material. So I believe that we would do just a little more publicizing so that we could provide basic science and energy and environmental education to more students.

Right now we are hitting only about a third of the student population in our service territory.

Michael Kirby: There's a follow-up question I'd like to direct to Marge and Milton. One of the most effective techniques for teaching people, particularly elementary school-age children these days, seems to be not only television but their incredible fascination with things such as Nintendo games. Has any consideration been given or have any programs been developed, Marge, either through your program or the work that you've been doing, Milt, that takes advantage of that natural learning environment as Walter described, and in fact attempts to capitalize on that as a learning tool in this direction?

Marge Qualls: No, at Puget Power we have not used video games as a learning tool. But it's an interesting idea, and one we probably should be expanding upon.

Milton McClaren: Yes, we have a couple of interesting things going on. We do have a centre at SFU called the 'EXCITE' centre, the exploratory centre for interactive technologies and education, where they are developing interactive systems which are Nintendo-like and they are doing some really neat things. We also have a big project out of Kelowna called the Southern Interior Telecommunications Project in which students can access experts on-line directly, through computer modems at their schools.

We have, for example, put scientists from the Ministry of the Environment's head office in Penticton on-line so that if a student in an elementary school wants to know about the deer eating things in orchards, which is a problem right now in the spring in the Okanagan, they can get on-line and talk to wildlife managers who don't have time to go to schools, who can't go out and visit these places, but can answer electronic mail requests. By 1993, we will have a high-speed computer network into every school in British Columbia, and we will have it into virtually every elementary school classroom, and every secondary school library and resource centre.

Now the question becomes, 'What kind of educational services are we going to make available on-line?' The most interesting part of the whole interactive television and computer business, is that students are actually creating their own interactive material for other students to use rather than just being the consumers of information created by adults. That's where the real fascination comes in.

Michael Kirby: There's a question really which is for the panel as a whole, and in light of many of the comments that have been made in the last couple of days, it is perhaps important for us to address this question in the closing session, 'How do we educate today's decision-makers to include energy efficiency in their management decisions in the same way that, for example, environment considerations or pay equity considerations and a variety of other considerations have been introduced?'

In other words, how do we make energy efficiency a main criterion in the decision-making system both in the public sector in government and indeed, in the private sector?

Marge Qualls: I can report that in Washington State our state legislature passed a law about a year ago mandating that energy would be a subject in the classrooms. We, as a utility, have a representative from our staff working on the state-wide committee comprised of many educators and scientists to develop that curriculum.

Walter Hardwick: I just would like to underline one of Milt's earlier comments about the question of systems thinking. People have to learn that we are living in an environment in which things can be used positively to create value but equally, things are dissipated. People must learn to ask, 'What kind of decisions are we going to make that will enhance organization and enhance life, and what kind of choices are we going to make that will bring about the dissipation of the things that we already value?

Dissipation is manifest in, say, the landfills that people can see and as smog from our automobiles.

The problem that I see with decision-makers is that they are used to running 'command and control' systems and that they understand and use the old hierarchical systems. It's difficult for executives to change from that kind of a mindset. So, it seems to me that if we have to do anything about people in senior positions, it's to help them to begin using systems thinking so they can see the interdependence of many of the things that they are dealing with.

Matt Hassen: The simplest single entrée as far as students are concerned and again, I'm harkening on curriculum, is consumer education which is a compulsory course at the secondary grade levels. That program includes comparative analysis of various kinds of products, whether it was the old Energuide labels or Power Smart labels, or fuel efficiency charts or whatever. The problem, in my view though, is that it's far too late. We should really be introducing some of these concepts at a much earlier stage because the Grade 2, 3, 4 and 5 students are consumers or are driving consumption and they too, can play a role. So we are going to have to find a way of introducing that at an earlier stage. But the common core point would be consumer education at present.

Norm Gilberstad: I would just make a comment that in very recent months the Ministry has, through it's science curriculum particularly, chosen to bring into balance objectives that not only address knowledge but attitudes and thinking skills. I guess attitudes is the term we use in British Columbia to disguise values. Other jurisdictions like Saskatchewan have openly developed, as part of their overall goals for education values, education through attitudes. Specifically, attitudes like curiosity, for example, and respect for evidence, and that kind of thing in science. If teachers would pay more attention to the development of high-order thinking skills, the opportunity would arise for focusing and organizing curricula around issues rather than around disciplines. This is consistent with what Milt has said about the need to have interconnections between the traditional subject areas.

What it can mean in time is a very different treatment of subjects in school, rather than they themselves being the focus. The approach would support other kinds of organizations, such as broad themes or issues.

Michael Kirby: Okay, let me ask one last question to the panel before turning the agenda for this afternoon over to Bob Wyman, the chairman and CEO of B.C. Hydro for closing remarks. And the question really brings together a lot of the discussion of the past few days and I'll ask Norm to comment first but I think the other panel members will also want to address it.

The question is as follows: Given the events of the last two days, it appears that a consensus has been reached that education related to energy efficiency and energy conservation should be taught in the schools. With the given budget constraints, increasing class size, increasing pressures on the educational system to do a lot more with less, is it realistic and practical to expect that this is likely to happen, and if it is likely to happen, who should pay for it? Should it be paid for by the utility? Should it be paid for by the Ministry of Education or should it be paid for out of local school board tax funds?

Norm, if you want to begin, but it seems to me that subject kind of brings together a lot of the comments that have been made in the last few days and really addresses the question, 'Are we dealing with purely a theoretical issue or is this something which can be practically handled?'

Norm Gilberstad: I don't know that anyone would know the total cost of such a program. It seems to me though that if we're offering teachers and students the flexibility to use a wide variety of resources, and that we're entering into a mode or a way of thinking that says partnerships are important and indeed many have come forward to the Ministry expressing the need to participate in what happens in schools. If quality resources are being developed in the private sector by business, by industry and so forth, then they deserve to be brought to the attention of educators.

A lot of money can be spent in that regard, developing good environmental material, because it will certainly be used, but teachers need to understand what they've been given. I always felt as a teacher that I would be prepared to use any good resource material. Often they came in printed form then, but now we have many more formats. And that's good, because there are different kinds of learners with different learning styles.

I think it's necessary for each unit, each school, to assess their situation and determine for themselves what they are prepared to do, what they can do in the short-term and in the longer term, in terms of restructuring the educational experiences for kids, taking into account that group of people's own strengths and the strengths of their students.

That may not involve the kind of cost that maybe the questioner intended. It's certainly a cost in terms of human energy, but then I think it's

just replacing energy that's being used now in a different way.

Walter Hardwick: I don't really think energy conservation is a significant curricular item. It's just a part of a much broader problem. The greatest role that everyone in schools can act is as exemplars: 'did you remember to turn the lights off?'

I was in a school district recently that was discussing whether or not they should blacktop the parking lot for the students' cars. Now, what kind of signals are they transmitting when the issue is if you should or shouldn't blacktop a parking lot for students?

Why do we have a parking lot for students anyway? Why aren't they on their bikes or why aren't they walking to school, or why aren't they acting in an energy and environmentally responsible fashion? Yes, one part of education is curriculum, but a lot has got to do with how we are living and how the exemplars within the schools as well as the homes act out energy and environmental conservation.

Milton McClaren: Well, I think Walter is partly right. We can't expect schools to fix all the problems of society, and that's what we tend to ask them to do. The schools just simply can't do that. We have to think about all of the messages that are being sent to kids. A survey that I think MacLean's magazine reported on last week, on Canadian teenagers, was interesting in that it said quite clearly that Canadian teenagers expect to have a higher standard of living than their parents.

If they expect to have a higher standard of living than their parents, does this mean in terms of the kind of consumptive lifestyle that we live now? If that's really their expectation, then we have a very, very serious social problem on our hands. That doesn't mean to say they can't have a high quality of life, but a high quality of life in the way that you and I know it in our consumptive lifestyles, I just don't simply think that option exists any more.

So we do need to start looking for models and examples. I think that there is a curricular problem and the curricular problem is not that energy isn't a topic on the books. Energy is covered on the books all through the school program. But if you present people with a fundamental little problem, for example if you ask a Grade 12 student, 'How much sunshine did you eat in your lunch today?', you will find that most of them have a great deal of difficulty coping with the problem.

That's because while they've been taught things like the law of conservation of energy, for example, a law which we could call inert knowledge. That knowledge is not really translated into behaviour in life and into thinking about the way the world works in practical terms. You can see evidence of that all around you, not only in the lifestyle of young people but in our own lifestyles.

So I think we have a curricular problem in the sense that we need to think about how to really organize the school program to help young people think about the important issues of our day using the great tools of the intelligence that we've developed, the great formal disciplines. That's a very exciting and interesting problem.

It's not a problem of simply realigning but it is definitely a problem of us thinking about what schools do now, what they need to stop doing, as well as what they need to start doing. Anybody will agree to change as long as it's additive, as long as we add more on or if somebody else has to do it, it's fine; but if you start to say, 'Well look, we need to do less better', then people are very defensive, as soon as they begin to think that what they do might now become part of the 'less', but I think that's the principal challenge. Our schools are absolutely loaded with information and low in knowledge.

Michael Kirby : Thank you. A final comment, Matt?

Matt Hassen: I don't think it's a major problem either. The exemplar idea that Walter raised is definitely true. I think that maybe where we make a mistake is that we have adults going around doing it and not involving kids. We replace lights with energy-efficient lights and we go around turning off switches and we go around closing the doors, but we don't engage kids in the process. We've got to make them aware that they have an important role to play.

We fall victim to the same thing at school that we do at home; we end up doing it for our kids instead of having them become the 'doers'

themselves. As far as curriculum is concerned, there are a number of places where the subjects and topics could currently be dealt with. So I would both agree and disagree with Milt.

One of the difficulties that I've encountered is that the information provided in the textbook is inadequate for any kind of thoughtful investigation. So it's given a kiss and a promise. It's given twenty minutes on one particular day and then the thing is gone. There may be a ton and a half of information available but one of the things we encountered when we were doing the energy education program was that most secondary student projects, including most elementary student projects failed, when the students couldn't get their hands on the kind of information they needed in order to thoughtfully explore and investigate and weigh and balance a complex issue.

When they couldn't find it in the school library or they couldn't find it in the local library, they mostly gave up. So one of the challenges is to help provide that kind of information or provide a base of information that students could make thoughtful investigations on and then come to some reasonable conclusions.

Michael Kirby: Thank you, Matt. Marge, any final comment?

Marge Qualls: Well, I was going to defer to the education experts, but let me add just one comment. About 12 or 15 years ago in Puget Power's service territory, schools would not let business come into the classroom because they were concerned about this very topic we're discussing, whether or not the information would be credible, would be just propaganda, and if there would be biases, and so on.

Today the schools are crying for business to come into the classroom. As I said in my presentation earlier this morning, I believe education needs the partnership of business and government to do the things it needs to do, and I believe that it is 'do-able' and it is a necessity.

Michael Kirby: Thank you, Marge. On behalf of the organizers of the conference and all of you who stayed for the final session. I want to thank all our panellists for taking the time to come and be with us. I'm now going to turn the podium back to Einar for the closing remarks. Thank you for your attention.

Einar Field: I'd also like to thank Mr. Kirby and the panel for their thoughtful comments and the responses, which gave us a quality conclusion for our Forum.

Questions Answered by the Panellists After the Forum

Question Directed to Matt Hassen: If you were asked to design a schools' program for a utility today, what would your major criteria for success be?

Matt Hassen: I'd say the major criteria for success would be the following:

(1) Both the sponsor (say, Hydro) and the users, (teachers/students) must feel that the program is useful and a benefit;
(2) There must be an increased level of communication between the sponsor (Hydro) and the school system, based on mutual trust, respect and interests;
(3) Dialogue must reach a point whereby intermediaries are no longer required: communicate directly;
(4) Extensive use must be made of teacher advisors to identify needs, to develop resources and to provide on-going feedback.

Einar Field: I'd now like to call on Bob Wyman, our Chairman, for his closing remarks.

Bob Wyman: Thank you very much, Einar.

Again, good afternoon, ladies and gentlemen. First of all, I would like to say thank you to all of those who participated in the Forum during the past two and a half days, to Pearson College for their assistance, to Conrad Guelke and his associates who have organized things so very well, to of course all the panellists and all the speakers.

To our Chairman Einar Field, a special thanks, because he made the program run on time, on schedule, and did an excellent job for us. Of course, I must thank our co-sponsors from the government and I particularly want to thank all of you who have joined us here this year to participate. I hope we see you back next year as well.

This is my first Forum and it has been an excellent opportunity for me to learn more about not only Hydro's programs but to meet many

representatives of our public.

I intend to make my concluding remarks in the form of a societal report card on the conference theme, that is, I will be giving out grades. Now, they're subjective, because I haven't communicated or talked to others about how I have graded the performance.

I don't mean specific grades for specific speakers but rather grades pertaining to the particular categories that were addressed. You might disagree with my grading system. Everybody passed; you all passed, but just barely.

Our keynote speaker, Frank King, I think did an excellent job. His talk was unique. He left us with a challenge, not just for the three days that we are here, but also for the future. To those of you who were not able to be here that night, he painted a picture that I can only describe as a vision of Armageddon, a portrayal of abuse or our most precious possession, our home, our planet, our earth.

On an optimistic note, he pointed out that our problems are potentially solvable if we work together, learn together and are far more responsible in the future than we have been at any time in the past. In my notes I have underlined 'at any time', and if I was a betting man I would say the odds are at best 50/50.

Turning to the specific themes, I hope it is clear that our first priority for meeting future electricity needs is through increased efficiency, through conservation on the demand side. Our Power Smart program is a most visible commitment of this priority. The Power Smart exhibition at the Forum has provided practical hands-on information for the public in Victoria and for conference delegates to use electricity more efficiency.

My grade for society's response to the urgings of Power Smart is a 'B,' and given that Power Smart really only started two years ago and has several years to run, I would expect to see that grade will go up even further as we move ahead.

Incidentally, Michael Kirby's presentation covered the subject of overcoming barriers to change, and motivational behaviour very clearly. He particularly stressed education in the lower grades, and that intrigued me, because I was thinking at the time of a program introduced by the Insurance Corporation of British Columbia some years back. I was on the board of ICBC. and I had fairly young children at that time, and ICBC introduced a program to send young people into the schools to talk about seatbelts and using seatbelts.

Michael, it was remarkable what occurred. Every time you would be driving along the street with your young daughter in the back seat she would say 'Buckle up', and even when she wasn't there you perceived that she was still sitting behind your shoulder, telling you to 'buckle up.' Through that program, the province of British Columbia achieved the highest level of seatbelt usage of any jurisdiction in North America. We were already well over 70 percent by the time the government decided to introduce mandatory seatbelt legislation.

So it was really the Corporation through the school system, through the young people, who impacted so very dramatically on people's behaviour. That might be one that you could use in the future, because it's a good example.

This Forum has discussed education for the first time and we have had many distinguished speakers provide many perspectives on the use of this vital resource to meet the challenge Frank King laid out for us. Marge Qualls' story about the girl and the watermelons growing on the vine was particularly apt. While public awareness of education is improving, a major task still lies ahead for industry and educational institutions in being more responsive to the needs and expectations of society as a whole. My grade for this issue is a passing grade of 'C.'

Again, a personal experience; some of you are aware I've been extensively involved with the university system for many years. When I first became deeply involved at the University of British Columbia, before the last restraint program, it was amazing to me, and I suppose I knew this, that so many people on campus felt it was not in their interest to communicate or to participate with their customers, the communities that they served.

They were living in a very cloistered environment. I don't mean all, but certainly a good many, far too many. That situation has changed dramatically in the last few years, at the institution

that I am closest to, the University of British Columbia, and I think that is obvious to all of you here. The university is far more outgoing today than it ever has been before.

I don't think that the University of British Columbia is unique, but it certainly is an encouraging thing and I think really it reflects the fact that what we need at universities and in the school system is more Janet Halliwell's and more Lon Mandrake's, who made such effective presentations to us during the last two or three days. As I say, a passing grade, 'C,', hopefully we're going to see improvement in that area as well.

On the subject of the environment, public awareness of environmental issues has increased to the point where society is listening and lawmakers are responding. There's still a long way to go. Frank King indicated this ten-year horizon; if we only have ten years it means we are going to have to do an awful lot in a short period of time.

At one time society's concern was that we're running out of energy. Now I would suggest it's been superseded by the theme that we're overloading our environment. At B.C. Hydro, I should note that I personally am determined that we continue to show leadership in respect to minimizing the impacts of our operations upon our environment.

In this context, at my second board meeting at B.C. Hydro, I asked the Board of Directors to support me in forming an Environmental Committee of the Board, and that has in fact now been done, and I will be chairing that committee myself.

My grade for society's awareness and response to environmental issues is a passing 'C+,' and again I would like to just give you a personal experience with I think is germane to this particular issue.

I have for several years been a member of the Board of Directors of British Columbia Forest Products Company, and I'm aware of the concern internally that company has for environmental issues, and yet it's my perception that the forest products industry, rather than being out in front of the issue, are trailing the issue, and they're trying desperately to catch up.

At this point in time, they are spending literally billions of dollars to reduce effluents; for example, in the area of dealing with pulp mill discharges.

Leonard Sagan's presentation on the EMF issue I thought was particularly appropriate in terms of a comparison, because the scientist who came up with the ability to measure the pulp mill effluents which until about six or seven years ago were referred to as trace elements, has indicated as recently as a month ago that despite what people think, he personally was not convinced that the impact of these trace elements and furans, etc., had really been proven to damage human health.

Yet we, as a society, have accepted the fact that these discharges are damaging and we are spending billions of dollars to counteract them, whereas at the same time there are so many other things that the forest products industry has to do, must do, and yet does not have the resources to do, because of this decision.

I thought that Dr. Sagan's comments as they reflected the EMF issue are ones that we at Hydro had better be very conscious of. As far as public involvement is concerned, we have heard back from the discussion groups and it is most instructional to compare the conclusions of the students with those of the adults. We of course will be listening carefully to what has been said.

Our annual Electric Energy Forums are an indication of B.C. Hydro's commitment to public involvement as a key input in the development of its plans to continue to meet electricity needs economically, reliably and with environmental responsibility. Any grade for public involvement has to be tied back to the grades achieved for electricity education and the environment. Thus, while B.C. Hydro is making great strides in this direction, the grade can only be improved as others improve.

Therefore public involvement also receives a passing 'C+.' I was discussing my idea of awarding grades in my closing remarks to one of my associates just before I came in here, and he said, 'I think I would give the adults a 'C-' and the students and the young people a 'B.'

Now, I'd like to just turn to the subject of next year's Electric Energy Forum. I'm pleased to announce that it will again be held here in Victoria, at this facility. The dates will be Sunday, May 10

to Tuesday, May 12 1992, and the Forum will be held in conjunction with the annual national conference of the Canadian World Energy Conference, that's abbreviated as 'CANWEC.'

I want to thank all of you for attending with us this year and hopefully we'll see many of you, if not all of you, next year. Thank you very much. Good afternoon.

Einar Field: Thank you, Mr. Wyman. Just a quick housekeeping item before you leave. Would those of you who have not yet turned in your Electric Energy Forum questionnaires, would you please complete them and leave them at the registration desk before you leave?

Now, I want to thank you all for your contributions to make this Forum a success; and thank you for attending, and we hope to see you all in '92.

HANDOUTS

BC hydro

Issues

Consumers need signals to conserve

Schools can teach link between electricity use and the environment

Consumer research shows utility customers need "market signals" to convince them that it is worthwhile to save electricity, Michael Kirby, vice-president of Goldfarb Consultants told the fourth annual Electric Energy Forum.

One way to achieve this, Kirby said, is to change the format of utility bills to include price per kilowatt-hour, how many kilowatt-hours of electricity were actually used, and in particular how this year's bill compares with last year's bill in total energy used.

Utilities in Ontario and California have adopted this practice, he added, enabling customers to say "goodness, I'm using a lot more or less electricity than I did a year ago."

Kirby added: "Consumers have told us they find this information very valuable, because if things suddenly get out of whack, they are able to understand it and begin to take action. That is the very least, in terms of feedback, that the consumer needs to get if, in fact, we're going to get market signals into the system."

He said more research needs to be done on ways, other than through the rate structure, to give consumers feedback on the amount of electricity they are using. The consumer must be able to experience a "clear benefit from consuming less or alternatively a noticeable cost from consuming more electricity."

It is not a valid argument, Kirby said, to claim demand management programs ought to be equally successful for the same reason as blue box recycling programs. He cited five barriers faced by electrical efficiency programs.

First, consumers find that using less electricity is not worth the effort. The second barrier is inconvenience– Canadians place a very high value on the conveniences of life which electricity makes possible. The third barrier is the

continued on page 2

Student winners for best "air fan car" at Design Challenge 91 at the Electric Energy Forum were from Pacific Christian School: Jack Van Domselaar, Robin Huppmann, Rebecca Smiley, Lora Bonnell, with teacher Mrs. Allen.

Electricity, education and the environment

was the theme for the 4th Electric Energy Forum held at the Victoria Conference Centre and sponsored by B.C. Hydro and the Province of B.C. *Issues* coverage of the Forum includes:

2 **New growth era must be less energy-intensive**
3 **Electric vehicles key to L.A. clean-up**
5 **EMF: Fact or fiction?**
7 **Get students involved**
11 **Put magic into teaching science**
12 **New efficiency standards help protect consumers**

New growth era must be less energy-intensive

Education and the proper application of science and technology are "absolutely critical if we are to find new and better ways of living on this earth," Frank King told the fourth annual Energy Forum.

In his keynote address to 250 delegates, King said any new era of economic growth must be less energy intensive than growth in the past. He noted that to bring developing nations' energy use up to that of the industrialized nations by 2005 would require a five-fold increase in present global energy.

King warned our planet's eco-system could not stand this "especially if the increases were based on non-renewable fossil fuels." He added, threats of global warming and acidification probably rule out even a doubling of energy use based on the present mix of primary resources.

To combat this gloomy picture, King said, energy efficient policies must be at the cutting edge of all national energy strategies for global development. "It is both possible and imperative that we find a safe, economically-viable energy pathway into the distant future," he said. "But it will take new dimensions of political will and institutional cooperation to achieve it."

Frank King answered questions from the floor following his keynote speech. Forum chairman Einar Field, vice-president, Human Resources, looks on.

King is president and chief executive officer of Metropolitan Investment Corporation and former chief executive of the XV Winter Olympic Games in Calgary.

He told the Forum to sustain the eco-system on which the global economy depends will require "widespread cooperation of development."

Since 1950 global manufacturing volumes have increased seven times, requiring more energy and more resources. To raise the developing world to our standards, King said, will require another ten-fold manufacturing increase. "The globe can't give much more... we can't take much more."

There is a solution, King told delegates. "The technology that we use to abuse the planet is the same technology that can help us heal it. We can recycle; learn from Nature to put back more than we take. We can replace; use more renewable resources, do better with less. And we can recognize our own common future. We are all in the same boat."

Consumers need signals *(from page 1)*

belief held by most consumers that they are already doing as much as they can to reduce electricity use.

The fourth barrier is the almost universal belief that the electric utility has an abundant supply of electricity. The fifth barrier to conservation is the inability of consumers to make a link in their minds between their electricity usage and the impact on the environment from generating that electricity.

"What is missing with respect to demand management," Kirby said, "is the acceptance by Canadians of the value or benefit to society of their using electricity efficiently. Without that, demand management programs are almost certain to have only limited impact."

Michael Kirby

Kirby said schools have a significant role to play in teaching children about the linkage between electricity usage and the environment. He added: "Only through this type of educational process will the value of electricity conservation become an integral part of the value structure of Canadians."

Los Angeles area Councilman Henry Morgan gets behind the wheel of electric vehicle on display at the Forum. He is briefed by Doug Turland from the Vancouver Electric Vehicle Association.

Electric vehicles key to L.A. cleanup

Los Angeles is attacking its smog problems with a plan to put 10,000 hybrid electric vehicles – known as ZEVs (zero-emission vehicles) – on the road by 1995, Forum delegates were told.

Henry Morgan, a councilman from Covina, California who serves on the South Coast Air Quality Management District Board, described the challenge facing authorities in the Los Angeles air basin who must clean up "the dirtiest air in the U.S." by 2010.

He noted the B.C. interest in electric vehicles – several of which were on display at the Victoria Conference Centre during the forum – and predicted they will eventually gain public acceptance. At present there is little incentive for the petroleum or auto industries to produce alternate fuel vehicles, Morgan said.

The California Clean Air Act of 1988 called for a 55% reduction in reactive hydrocarbon emissions from vehicles by the year 2000. The legislation also aggressively targeted other pollutants and air toxins.

The California Energy Commission set new, tougher emission standards for vehicles. Authorities in the LA area approved an initiative to put 10,000 hybrid electric vehicles on the road in the South Coast air basin by 1995. Supporters claimed that "unless we do it, nobody will" and funds were committed for development of ZEVs. ZEVs are being designed to emit "no regulated pollutants," Morgan said.

By 1998, Morgan said, plans call for 40,000 electric vehicles in the LA area. Thirteen million people live in the basin. They drive 9,000,000 vehicles a daily average of 240,000,000 miles "making the car the chief culprit in air pollution."

Morgan said the price of air pollution in the area is estimated at $10 billion a year. By age 12, many youngsters suffer a 15% reduction in lung capacity.

Because county boundaries don't affect where the air goes the South Coast Air Quality Management District was set up and "given the financial horses to clean the air and protect the environment" throughout the basin.

Jack Davis tribute opens Forum

The fourth annual Energy Forum was dedicated to the memory of the late Jack Davis, former B.C. Minister of Energy, Mines and Petroleum Resources.

Chairman Bob Wyman asked the 250 delegates attending the opening session of the three-day forum to observe one minute of silence in memory of "a truly great British Columbian." He noted that while Davis spent years as the provincial minister responsible for B.C. Hydro, it is sometimes forgotten that his business career began as an employee of the utility.

"Jack Davis oversaw our growth from a rather insular construction-oriented company to the present open, conservation -oriented utility... which ranks as a leader in the efficient use of electricity in North America," said Wyman.

The chairman also paid tribute to his predecessor, Larry Bell, who started the Energy Forum three years ago to exchange information about resource plans and policies with the public. "Jack Davis believed in the importance of public discussion of energy issues and in the value of these forums. Larry Bell made sure his wishes were carried out," he said.

Jack Davis served as the director of research and planning for B.C. Electric in the late Fifties and early Sixties. He became Canada's first minister of the environment 20 years ago.

AIR YOU CAN'T SEE

On a sparkling spring day, Councilman Henry Morgan, a member of the South Coast Air Quality Management District Board, charged with cleaning up air pollution in Los Angeles by 2010, drew a bemused chuckle from Forum delegates. He opened his speech by saying: "I do have a problem with coming to Victoria, folks. How can you possibly breath air that you can't see?"

$250,000 for Environment Youth Corps

B.C.'s Minister of the Environment praised Hydro for its "high level of corporate citizenship" for donating $250,000 to the Environment Youth Corps.

David Mercier told a Forum luncheon students will have a better understanding of environmental issues if they are woven into courses on other subjects.

"Since the environment touches all subjects," Mercier said, "we must build environmental literacy into our education system. It can't be layered on as another subject in our already crowded course program. By making it part of every subject students will learn to plan and think critically and eventually to move from thought to action."

The minister said the Hydro donation – "a wise investment in the future" – will be used to take the message of sustainable development to classrooms throughout the province. The Environment Youth Corps is a good example of transferring environmental concerns to action. The program provides environmental and conservation experiences for young people aged 16 to 24. They work on projects like fish habitat and trail improvement, supplemented by book work on environmental issues. They, in turn, inform thousands of other young people throughout B.C.

Dave Mercier

Mercier said his ministry has formed a working group with the Ministry of Education to identify new opportunities for building environmental knowledge into our school programs.

Hydro chairman Bob Wyman with, from left, Allan Ball, president, and John Pettifer, executive director, Scouts Canada, B.C. and Yukon Council, Mrs. Jean Goulson, deputy commissioner, Mrs. Tad Letson, environmental coordinator, Girl Guides of Canada, B.C. Council.

Scouts and Guides get PS message

More than 70,000 young people and adults involved in Girl Guide and Boy Scout activities will be exposed to a new Power Smart program teaching energy efficiency and electrical safety.

Chairman Bob Wyman announced the joint undertaking during the Forum and paid tribute to both organizations for their leadership and concern for education and the environment.

The Girl Guides of Canada, British Columbia Council, were represented by Mrs. Jean Goulson, deputy provincial commissioner, and Mrs. Tad Letson, environmental coordinator.

Allan Ball, provincial president and John Pettifer, provincial executive director, represented Scouts Canada, B.C. and Yukon Provincial Council.

Goulson told delegates Guides were already aware of environmental concerns. She added: "We have 35,000 girls and women involved in this province and we thank you for this opportunity to spread the Power Smart message."

Ball said he looked on the Power Smart program as an opportunity to "go out and research what the need to conserve our energy is all about." He added: "We hope other corporations will pick up on that so that we have an opportunity to take our 26,000 youth and 10,000 adults further into the wise use of our resources."

Scholarships announced

Four new Power Smart scholarships worth $1,000 each will be awarded annually to students attending B.C.'s major post secondary institutions.

Chairman Bob Wyman told Forum delegates other announcements in the current expansion and modernization of B.C. Hydro's scholarship program will be made in the next few weeks and months.

Students at the University of Victoria, University of B.C., Simon Fraser University and B.C. Institute of Technology will be awarded the scholarships for achievements in engineering, business and environmental resources. Each must have completed a major project or paper related to energy conservation.

EMF: Fact or fiction?

It"s still too early to tell, says EPRI expert

Extensive studies into the effects of electro-magnetic fields (EMF) have not yet produced any conclusive findings about danger to workers or the public, according to one of North America's leading experts on radiation studies.

Dr. Leonard Sagan, manager of the radiation studies program at the Electric Power Research Institute in California (EPRI), told a Forum audience: "In my opinion it is far too early to make judgments about whether the risk is real or not. Certainly it is too early to make judgments about what should be done should there be a risk."

Sagan said this is a complex issue and the public is "poorly equipped" to judge evidence about the threats to public health. He added people are "easily misled" by media reports and other events dealing with environmental or dietary factors and cancer. Some of these fears have turned out to be justified; Sagan cited asbestos and cigarettes.

Science teaching in our schools about public health is "particularly poor," Sagan said.

Newspapers generally have done a good job of reporting on magnetic fields and cancer. TV has not, with its sound bites and tendency to sensationalize issues. Scientists for their part, Sagan said, don't communicate well enough.

He offered delegates this advice: "When you read of a cancer link ask yourself these three questions.

1. "Is the epidemiological evidence sound? Has the study been replicated so that we can discriminate between associations and causation?

2. "Since epidemiology can be fallible is there confirming laboratory evidence? What happens to animals when they are exposed, almost always at high exposures hundreds, even thousands of times what people experience in their daily lives?

3. "Is there a plausible mechanism? Do we know how A causes B? If we do that strengthens the evidence."

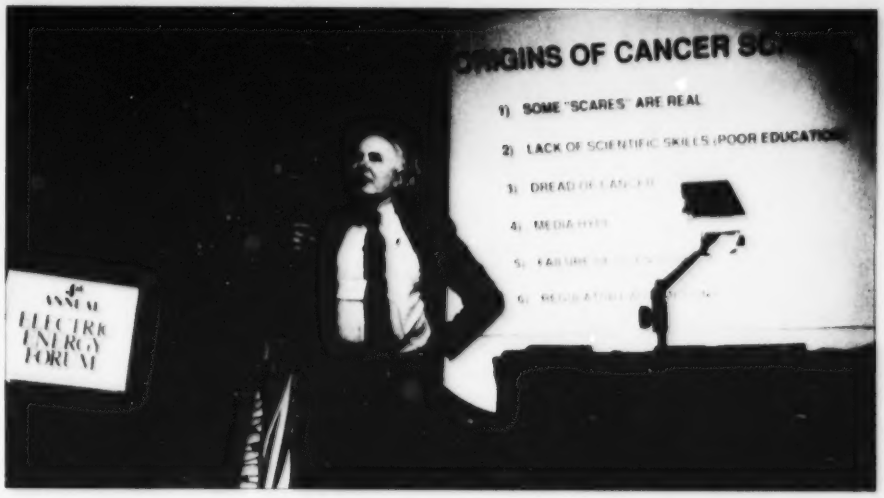
Sagan said laboratory studies using rats are now being carried out in California under the auspices of the EPRI, at U.S. National Institute of Health, in Quebec and in Sweden. In these experiments, he said, laboratory animals are exposed to cancer-causing chemicals and then magnetic fields to see if there is a change in the frequency and behaviour of tumors. The results won't be known for three or four years.

A questioner from the floor asked the speaker if utilities should educate and inform consumers about EMF "even if it means admitting we don't know all the answers?"

Sagan said the electric utilities who are members of the Electric Power Research Institute support the largest EMF research program in the world. He added: "In the U.S. most utilities take the view that everybody is better off if the public is informed. This is a change because in the past most industries felt it was better not to tell."

Another questioner asked if EPRI wasn't just another Tobacco Institute set up to stonewall difficult questions about health links.

"It's not like that," Sagan said. "Nobody is going to give up electricity, no matter what the research shows. It's just too important. What utility managers can't stand is the uncertainty. So it's in the utility interest and the public interest to try and resolve this issue with an informed public."



Radiation studies expert Dr. Leonard Sagan says utilities and the public must work together to solve the EMF puzzle.

POWER SMART UNIVERSITY

Dr. David Strong, president of the University of Victoria, was presented with a framed copy of the contract between the university and Power Smart by Chairman Bob Wyman. The agreement is designed to reduce UVic's power bill which now runs to $1 million annually. B.C. Hydro is also a co-sponsor of the 1994 Commonwealth Games. The energy efficient athletes' village will become a student residence after the games.

Partnerships being built to meet future shortage of skilled workers

B.C. Hydro is building alliances and partnerships in education with its stakeholders to meet a critical shortage of skilled workers for the future, the Forum was told.

Tazeem Nathoo, project manager for Partners in Education, told delegates that improving our education system is crucial not only to Hydro's future, but to the competitive position of B.C. and Canada in a global economy.

She said volunteers among Hydro's employees and retirees from the corporation are being encouraged to join in the educational program.

All B.C. employers face a shortage of skilled workers because of declining enrolment in science and technology courses. Canada will have 50,000 unfilled jobs for engineers by the year 2000. Meanwhile, Hydro, with two-thirds of its employees age 40 or older, faces a situation made worse by the loss of apprentices, technicians and engineers in the early 1980s.

"Our Partners in Education program is an integrated and focused strategy that addresses our human resource requirements, carries the Power Smart message, and raises awareness of electrical safety in the education sector," Nathoo said.

She told delegates that 30% of Grade 9 students in this province drop out before completing high school. In Japan the dropout rate is 3%. In B.C., by age 17 only 72% of students are in education or apprenticeship training compared with 89% in Germany and 94% in Japan.

"Through Partners in Education we are involved in 30 projects from elementary school to university. All our efforts stress the importance of high school graduation, completing math and science courses, committing to lifelong learning and developing good communications and team-playing skills," Nathoo said.

Plans for the near future include using volunteers as mentors, tutors and public speakers. Volunteers are already helping high school teachers make presentations about the "terrific opportunities in trades and technology" and to encourage women to enter science and technology.

Tazeem Nathoo, left, project manager for Partners in Education, and Marge Qualls, Puget Sound Power and Light, discuss common problems of attracting skilled workers.

Education connects environment, economy

Utilities must look for new ways to serve their customers better, and education is both good business and good citizenship, according to Marge Qualls, director of consumer affairs for Puget Sound Power and Light Company.

"We need to recognize and enable the public to recognize that environmental questions are economic questions," she told a Forum audience. "We need to weigh the environmental and economic impacts of each proposed way of producing or transmitting electricity. We must never settle on one solution as the final one, but always research and explore new and better ways."

Qualls said Puget Sound Power and Light recently conducted a five-month in-depth review of its educational programs. The study involved company employees and teachers as part of a strategic planning process for the 1990s.

"Corporations have a real opportunity, if not an obligation, to put our money where our mouth is," said Qualls. "The time and money we invest in environmental education today will quite literally mean a better, cleaner world for tomorrow. We encourage young people towards careers as engineers, ecologists, biologists, and energy planners.

"These partnerships will bring the world of school and the world of work closer together."

To educate students, get them involved

A panel of educators agreed the best way to teach young people about conservation and the environment is to involve them in energy saving activities both in school and at home.

Mat Hassen, director of personnel for Burnaby school district, told the Forum we are making a mistake when adults carry out conservation practices without involving the kids. "We replace incandescent lights with energy-efficient bulbs," he said. "We go around turning off switches and closing doors. But we don't engage kids in the process, making them aware they have a role to play."

"We end up doing the same thing at school as we do at home; we end up doing it for the kids instead of having them become the doers themselves."

Walter Hardwick, professor of Geography at UBC, told delegates energy conservation is just part of a very much broader problem. "The greatest thing is that everyone in school act as exemplars. Do you turn lights off? Why provide parking for kids? Why not let them ride bikes or walk and do other things that are energy- and environmentally-responsible?" he said.

"One part of the problem is curriculum," Hardwick said, "but a lot has to do with how we're living and how people who are exemplars within our schools as well as at home act out energy and environmental conservation."

Milton McClaren, associate professor of education at SFU, said society can't expect schools to solve all our problems. "We have to think about all the messages that are being sent to kids. A recent survey in Macleans magazine showed Canadian teens expect to have a higher standard of living than their parents.

"That doesn't mean they can't have a high quality of life. But a high quality of life in the way you and I know it in our consumptive lifestyles – I simply don't think that fix is on."

Norm Gilberstad, curriculum development branch of the Ministry of Education, said teachers and students should be given enough flexibility to use a wide variety of learning resources. "If quality resources are developed by the private sector and by industry they deserve to be brought to the attention of educators," he said.

Marge Qualls, Puget Sound Power and Light Company, said 12 to 15 years ago schools in her service area wouldn't allow business into the classroom because they were concerned about credibility and biases. "Today the schools are crying for business to come into the classroom," Qualls said. "Education needs the partnership of business and government to do the things it needs to do. I believe this task is do-able and it is a necessity."

Critical thinking skills needed

A panel of experts debating issues in education agreed that all courses should include some science and teach critical thinking skills.

High school teacher Lon Mandrake told the Forum the Ministry of Advance Education is running workshops dealing with how to encourage female students to continue their studies in science. He said some school counsellors actually discourage girls from careers in science and suggest they train for jobs in business as typists and secretaries.

Panel chairman David Scott, professor of mechanical engineering at the University of Victoria, noted that Janet Halliwell earlier told delegates the critical ability to appraise systems and concepts must be accessible to a wider public.

"It is vitally important," Scott said, "that we see electrical energy as a system. We harvest a resource, hydro, to make a currency, which is electricity, and then employ technology to provide a service to the end user.

"But we must see this system in a holistic sense where there are inputs from the environment and emissions to the environment at each point in the system."

Halliwell, chairman of the Science Council of Canada, said this country has a low investment in research and development intensive activities. She added: "We don't as a country celebrate our successes enough. We have an electric car on display here, we have a hydrogen fuel cell on display, but we are not using them to capture public interest."

Power Smart message was delivered by Shell Busey, who took his popular Home Ideas Show to the Forum.

Getting young people involved

Young people were well represented at two successful events which ran parallel to the fourth annual Energy Forum. An alternate conference drew more than 100 Grade 11 and 12 students who discussed energy education and the environment. Students in grades 6 - 9 from southern Vancouver Island participated in a morning-long Design Challenge 91. Using little more than drinking straw and masking tape they constructed energy beamer towers, gliders, and air fan cars. Chairman Bob Wyman and the honourable Bruce Strachan, Minister of Advanced Education, Training and Technology, presented prizes to category winners.

Science and technology are part of the solution

A properly educated population is the key to intelligent stewardship of Canada's natural resources, says the chairman of the Science Council of Canada.

Janet Halliwell

Dr. Janet Halliwell told the Forum most of us must change our attitudes towards science and technology. In seeking conservation of resources and protection of the environment, she said, "we must not renounce science and technology. We must not slow development so that we step into an economic backwater.

"We must use Science and Technology as part of the solution to our conservation and environmental concerns in the 21st Century."

She warned us not to be lulled into complacency by B.C.'s remarkably efficient and clean energy source. "We cannot be parochial and think only of Canada because energy issues are trans-national. Pollution in Canada's Arctic originates in the coal-powered generating stations of central Europe. And we have to remember our hydro and nuclear power won't run cars or ferries or jets."

World population growth is the real driving force for energy demand, Halliwell said. We are adding one billion people every 11 years, 80% of them in developing countries. She warned by the mid-21st Century we can expect a ten-fold increase in energy demand.

"The biggest challenge and therefore the biggest opportunity for the Energy Industry of Tomorrow is the integration of science, technology and innovation with our Canadian society, our economy and our culture," Halliwell said.

"We must empower all Canadians to make informed judgments on how to deploy science and technology. We have allowed science and technology to become isolated from society, thus creating an apparent antagonism between energy and economic issues (on the one hand) and the quality of life.

"Society must come to terms with technology," she added, "especially nuclear power, as a major future energy source, and the over-reliance on fossil fuels in transportation."

Halliwell said if citizens are expected to make effective judgments on science and technology "there must be a radical shift in our educational system to make them accessible to all, not simply practitioners."

Young people must be taught to deal with systems – ecosystems, energy systems and industrial systems – rather than just pieces of that puzzle. Everyone must be empowered to take part in a public dialogue making scientific issues accessible to the public. Halliwell said this will provide a "more effective way to openly assess risks and benefits."

Canadians must also be more sensitive to energy's global context, appreciating the pressures and opportunities that lie beyond our boundaries. And we must embrace but go beyond a conserver society. "Our goals can only be achieved in a knowledge-based society, a society with a global outlook, where scientists and engineers can contribute to the public debate."

Refrigerator buy-back program is helping to establish a new energy efficiency ethic

B.C. Hydro is buying back many of the estimated 300,000 power hungry second refrigerators British Columbians keep in their basements, says Derek Henriques.

Henriques, manager of Hydro's energy marketing division, told Forum delegates the energy saved by not having these outdated appliances plugged in would be "a tremendous advantage to us."

Derek Henriques

To the end of January, 1991, Henriques said, over 122,000 residential customers had participated directly in Power Smart rebate programs. Rebates were paid out to 3,000 commercial customers and 800 in the industrial sector during the same period.

Henriques said Power Smart wants to establish a new "energy efficiency ethic" in which energy use becomes part of all business and personal decisions. Power Smart is doing this by showing customers they save money by using less energy, influencing new purchases of appliances and equipment, and providing leadership in developing efficient performance standards for all energy using equipment.

Power Smart works, he said, because it creates a synergy of partnerships between the utility, manufacturers, retailers, governments and, most important, consumers. Among recent successes are the University of Victoria which has opted for Power Smart; the Commonwealth Games will also be Power Smart.

Victoria has installed compact fluorescents in its ornamental waterfront lighting at a 75% energy saving. Ornamental lighting on the Legislative Buildings was retrofitted last year with 40% electricity savings, and "very little additional cost" for equipment, he said.

Put magic into teaching science–Mandrake

A Delta high school science teacher startled Forum delegates by opening his speech with a spectacular burst of flame from a small jar placed on the podium.

Lon Mandrake, a magician and recipient of the 1990 distinguished service award from the B.C.Science Teachers' Association, chose as his topic bringing science to life.

Only two years ago, Mandrake told delegates, top B.C. students at the Grade 9 level were ranked first in the world in knowledge of science and higher level thinking skills. Yet science is not considered either a rewarding subject or career in our society.

B.C. surveys show thae average student interest in science peaks at Grade 3 and by Grade 9 most students wouldn't take science if they didn't have to, he said.

Mandrake warned there is a growing shortage of scientists and technicians in North America which universities and colleges are powerless to stop while young students continue to drop out of science courses.

Burst of flame captured audience attention when magician and high school teacher Lon Mandrake stepped to the podium.

"We have to show students how science applies to their daily lives," Mandrake said. "We must show (students) science is a dynamic, exciting human endeavour that can be accomplished by anyone, not just an eccentric few."

This requires use of different teaching strategies that allow students with different learning styles to become involved and excited about science. Mandrake uses magic tricks, puzzles, and asks students to report on TV, radio and public lectures.

He adds, "If we enjoy it, it rubs off. If we're not happy, students say 'why choose that career?'"

DEPUTY MINISTER SAYS:

Electricity efficiency is key to Hydro challenge

The shift in emphasis to sustainable development of B.C.'s electricity resource is placing an additional premium on energy efficiency, according to John Allan, deputy minister of Energy, Mines and Petroleum Resources.

"B.C. is in the midst of energy plenty and the cost picture is relatively attractive," Allan told delegates at a forum luncheon where he filled in for the minister, Jack Weisgerber. "But the emphasis on sustainable development is making us look at all the costs – financial, environmental and societal."

At this stage in the industry's development, Allan said, "there is much scope for efficiency gains through competition and private sector participation in the electricity industry." Hydro's transmission lines are becoming common carriers. Industrial customers are going into self-generation. Power exchanges and demand side management are increasingly important.

These activities help create opportunities for the private sector to develop, manufacture and install new energy-efficient technologies, the speaker said.

The deputy minister added Hydro will continue to serve the core market of residential customers and those with no alternate sources of power as well as industries who want to continue to buy from the utility. Low cost generating sources provided by Independent Power Producers will attract new industries in the vicinity of the hydro plant with rates lower than those charged by Hydro.

"The challenge of the 90s and beyond is to continue transforming the province's power potential into a sustainable level of economic development while maintaining a high level of environmental integrity," Allan said. "We will place more reliance on market efficiency within a frame of well-defined regulations and environmental standards."

New efficiency standards help protect consumers

By 1994 less than five per cent of the refrigerators now on the market will meet new B.C. energy efficiency standards, according to Warren Bell, director of energy management for Energy, Mines and Petroleum Resources.

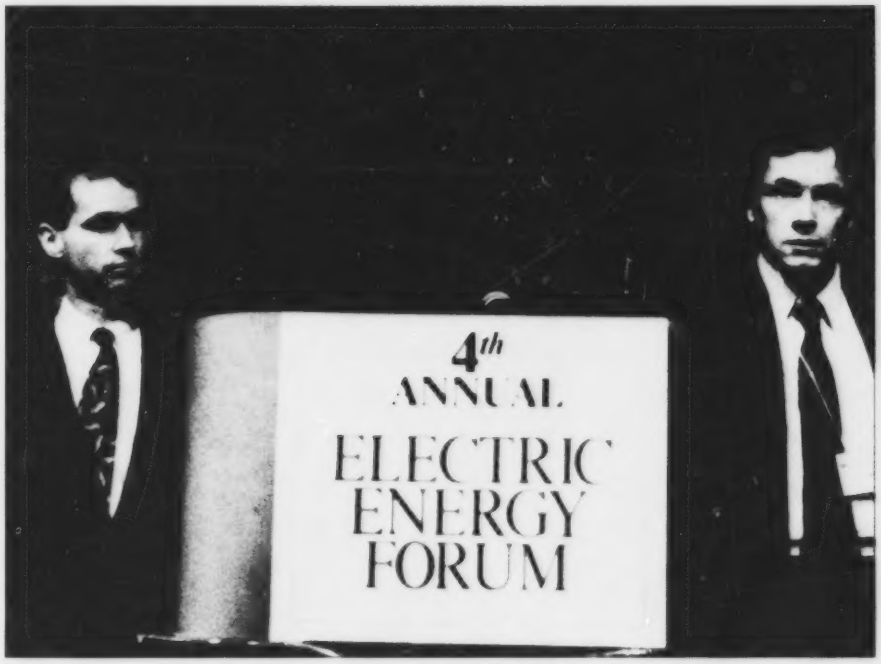
He told Forum delegates the provincial government is protecting consumers by keeping energy wasting equipment off the market. The Energy Efficiency Act, which took effect May 1, spells out new standards of efficiency for fridges, ranges, water heaters, dishwashers, air conditioners and a wide range of other appliances.

"These new refrigerators will be an example of energy conservation savings without performance loss," Bell said. "The average refrigerator today uses 1400 to 1500 kW.h of electricity. In 1994 the only refrigerators sold in B.C. will use less than half of that amount. This will require a dramatic change in refrigerator manufacture."

In Canada, B.C. is second to Ontario in establishing such standards. The leader in the field is California which passed laws governing appliance efficiency in 1985. Later this year B. C. standards will be extended to electric and fluorescent lamps. Next year there will be tougher standards for gas appliances including furnaces and refrigerators.

Taking a leaf from B.C. Hydro's Power Smart book, the government is planning later this year to launch a Fuel Smart program. This program will introduce mandatory emission tests for all vehicles in the Lower Mainland. Partnership programs will be extended to ride sharing and driver training for fuel efficiency.

Fuel Smart program aims for similar ethic change as Power Smart



Role of provincial government in the promotion of energy policy was outlined by Warren Bell, left, director of energy management and Peter Ostergaard, assistant deputy minister, Energy, Mines and Petroleum Resources.

"Fuel Smart is going to be a bottom-up program," Bell said. "We'd like to hear from our partners. We can pass regulations and enforce them. But it is probably only by working together that we can get where we're going."

The objective of the Fuel Smart programs is to reduce oil consumption and increase energy efficiency, Bell said. The success of Power Smart is due in large part to its emphasis on creating a conservation ethic. Fuel Smart will aim for a similar "ethic change" because without it, he added, "all you've got is a series of unrelated programs."

Bell said organizations like B.C. Hydro will be part of fleet management programs which could result in a 50% energy cut over the next three years. The government itself plans one third of its new vehicle purchases will be powered by alternative fuels.

Peter Ostergaard, assistant deputy minister of Energy Mines and Petroleum Resources, reviewed energy policy in the province. In response to a question from the audience, Ostergaard said he expects passive solar performance standards to be introduced.

He said new building standards for energy conservation are now mainly concerned with insulation. "I suspect what might happen in a couple of years," Ostergaard said, "particularly in a coastal location like Victoria where people want numbers of windows on the view side, we may introduce passive solar performance standards. These would require a standard of kW.h per square metre of internal air area. This would leave developers no choice but to build in solar reflectors."

Demonstrations by staffers from Science World in Vancouver drew groups of fascinated spectators in the lobby of the Forum.

Hydro to move faster on the environment

Bob Wyman told 250 delegates attending the fourth annual Energy Forum in Victoria he is convinced "the environment is the biggest issue we'll face during my time at B.C. Hydro."

Noting that one of his first official actions this spring was to assure Hydro employees that a new chairman "doesn't mean any lessening of our efforts to improve environmental consciousness," Wyman added: "In fact, I intend to get Hydro moving faster in this area."

Two days before the Forum opened April 16, Hydro's directors approved establishment of a special committee of the board on the environment. Wyman himself will head the new committee.

"I firmly support the corporation's environmental principles," the chairman said. "I am convinced that the environment is the biggest issue that business faces now and in the next decade."

Hydro has come a long way in its environmental awareness in a relatively short time. "We're getting there," Wyman said, "but we still have a long way to go."

Employees must be "in the know"

Chris Boatman, vice-president of corporate and environmental affairs, told the Forum the corporation's employees are the key to B.C. Hydro communications with a larger public.

"We're not going to get very far in dealing with anyone unless our own employees know what's going on," Boatman told the delegates. To achieve this, formal and informal methods are being developed to "listen to employee views and seek their input in decision-making."

One result, Boatman said, has been a change in management approach to "allow those who have the best information to make the decisions."

"The communications challenge of the 1990s is to manage how we as a society are going to perceive the use of electricity as it relates to the environment," Boatman said. "We know the environment is a major concern. We know the generation and distribution of electricity affect the environment. We assume the public has a vested interest in the efficient use of electricity.

"It's not our role to preach, but to inform. It's our job to tell the public what the choices are and to work with them to determine the best solutions."

Boatman told delegates: "Communication in the 1990s means complete acceptance on our part that what you have to say is every bit as important as what I have to say."

SOLID SUPPORT

B.C. Hydro's annual Energy Forum is continuing to attract solid support from provincial government ministries. The first in the series was co-sponsored by Energy, Mines and Petroleum Resources. This year, the 4th Energy Forum, held at the Victoria Conference Centre April 16-18, had four government co-sponsors. They were, in addition to Energy, Mines and Petroleum Resources, the Ministry of Education, Ministry of the Environment, and the Ministry of Advanced Education, Training and Technology.

Youth discussion group popular; some adults seek change in '92

About 100 Grade 11 and 12 students attending a parallel conference as part of the fourth annual Energy Forum gave a rousing endorsement to their opening dialogue with B.C. Hydro.

Some of the 250 delegates attending the main Forum expressed reservations about the short duration of the discussion sessions, spread over two days, and suggested changes. But the overwhelming majority want further involvement in discussing energy education with Hydro.

Chris Kask, a Grade 12 student at Victoria High School, spoke to the forum on behalf of his fellow students. He said they discussed the same issues as the delegates, with emphasis on the Partners in Education program.

Chris Kask

The consensus was, Kask said, that the discussions were "very worthwhile" not just for the students, but for Hydro as well. "I and the others felt it was important to get students involved, because we have a lot of ideas that should be heard."

Asked if Hydro should plan another youth conference as part of next year's forum, Kask said, "there was a resounding yes, because I think it worked very well. There were a lot of good ideas that you can't get sitting in committee. Group work works."

One idea recommended by almost every youth group, Kask said, was the establishment of a "progressive billing" system to let consumers know "once they use over a certain amount of electricity they are going to pay more for it."

Among other ideas was a network of students who would spread the idea of electricity conservation and safety to other students and their parents. They also felt Hydro advertising should "scare people" into believing that if they left lights on a new dam would have to be built.

Jim Savage, who coordinated the main forum sessions, said over 70% of delegates felt similar discussions should be a part of future forums. About the same number felt the objectives established for discussion groups were satisfactory.

Savage said improvements suggested by delegates included having only one group per room, to get background information on discussion topics into delegates hands earlier, and to hold one longer discussion session rather than spreading it over two days.

From the floor there were other suggestions for improvements.

These included: having a Hydro person available to answer questions during group discussions; having someone from "the environmental community" as part of the planning team; and to abandon written questions in the general sessions for live questions from a floor microphone.

One delegate said the present system didn't allow followup questions and there was a perception that this year's discussion format was "contained and directed" which left some participants feeling frustrated.

Product diversity helps environment

The public should take as many product factors as possible into account when trying to make informed decisions on environmental impacts, according a University of Victoria scientist.

Dr. Martin Hocking, associate professor of chemistry at UVic, told the Forum, diversity is useful not only in genetic terms but also in making wise product choices.

He discussed research into the environmental impact of the use of polystyrene and paper drinking cups. After reviewing a wide range of factors, including energy used in manufacturing and biodegradability of the finished product, Hocking concluded there was little to choose between them.

Despite perceptions that paper cups have a lesser impact on the environment than polystyrene, Hocking said, this was not borne out by his experiments. "The choice is not as black and white as the public has perceived over the past few years," the speaker said. He urged delegates to use a diversity of materials to "improve the economy of overall resource utilization."

"GREEN AWARDS" PROPOSED

"Green Awards" matching the prestige of the Academy Awards and the Nobel Prize should be established and given to "people who are doing great things to preserve endangered species and protect the environment," according to Forum keynote speaker Frank King, Calgary. The speaker said: "What industry is doing (at this Forum) is the kind of thing we need more of in this world. If industry would invest more in children there would be a better world 20 years from now."

Making it work!

As in past years, discussion groups at this Forum provided a good opportunity for sharing ideas on energy, the environment, and other issues. The feedback obtained from these sessions is an important part of Hydro's planning process. It takes a lot of work by dedicated staff members to make the process work as smoothly as possible.

Chairman closes Forum with his report card

Bob Wyman elected to make his closing address to the successful fourth annual Energy Forum "a societal report card."

The chairman said he found his first forum an excellent opportunity to learn more about Hydro's programs and to meet our stakeholders. He added his grades were subjective and related only to the categories addressed over the three days.

Wyman said he had reservations about Frank King's view, expressed in his keynote speech, that the world's environmental problems "are potentially solvable if we all work together, learn together and we are far more responsible in the future." The chairman added: "If I was a betting man, I would say the odds at best are 50/50."

The first priority in meeting future electricity needs, Wyman said, is increased efficiency and conservation on the demand side. "Power Smart is our most visible commitment to this goal," the chairman said. "My grade for society's response to the urgings of Power Smart is a 'B'. Given that Power Smart only really started two years ago and still has several years to run I would expect to see that grade improve as we move ahead."

While public awareness of education is improving, Wyman said, there is still a major task ahead for industry and

Bruce Strachan, who was Minister of Advanced Education, Training and Technology when the forum was held, above right with Bob Wyman, toured Design Challenge 91.

educational institutions to become more responsive to society's needs and expectations. "My grade for this issue is a passing grade of 'C'. Hopefully we are going to see improvement in this area as well."

The chairman said public response to environmental issues has increased to the point where society is listening and lawmakers are responding. "At one time," he said, "there was a concern that we are running out of energy. Now, I would suggest, that is being superseded by the theme that we are running out of the environment."

Wyman told delegates: "My grade for society's awareness and response to environmental issues is a passing 'C+'. These annual forums are an indicator of Hydro's commitment to public involvement as the key input in development of plans to meet B.C's electricity needs economically, reliably and with environmental responsibility."

While Hydro is making "great strides" in this direction, the chairman added, the grade can only be improved as others improve. "Therefore, public involvement also receives only a passing 'C+', although one of my associates suggested the adults should get a 'C-' and the students and young people a 'B'."

WHALE PRINTS PRESENTED

Gifts of appreciation to speakers at the Forum were framed prints of a painting by West Coast artist Mark Hobson depicting two killer whales pursuing a seal through a kelp bed. Hopson, a biologist, taught at Shawnigan Lake school and worked as a nature interpreter at Pacific Rim National Park before becoming a full-time artist.

DATE SET FOR 5TH FORUM

The annual Energy Forum will again be held in the Victoria Conference Centre from Sunday, May 10 to Tuesday May 12, 1992. Next year's event will be held in conjunction with the 14th annual Canadian National Energy Forum.

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NEWSPAPER
CLIPPINGS

The Times Colonist (Victoria, B.C.)
APR 15 1991

288

Hydro pours energies into field of education

The growing importance of energy issues and the need for highly-skilled employees is deepening B.C. Hydro's involvement in education.

Last August, the Crown corporation started "Partners in Education," an umbrella program to co-ordinate its educational activities and ensure consistency in its message.

Tazeem Nathoo, project manager of Partners in Education, says the program isn't purely altruistic — it's enlightened self-interest.

"Partners in Education makes good sense, ensuring that the company has a broad base of highly skilled employees to draw from in the future. Also, today's students are tomorrow's customers, so we are instilling a Power Smart and safety ethic."

She says that while various Hydro departments have been active in education for years, Partners in Education ensures the wise use of Hydro's educational resources — integrating rather than duplicating programs.

At present Hydro is sponsoring 23 educational projects from energy-education kits for primary school students to university graduate course lectures.

Partners in Education also extends beyond the school system, involving a work-placement project through the Native Friendship Centre in Prince George, the broadcasting of "Hydro Game Shows" through *Kidzone* on the Knowledge Network and the 4th annual Electric Forum, which is taking a look at education and energy issues.

"We have an ambitious vision," says Nathoo. "But it's a vision that can only be accomplished through the sharing of time and skills."

She says that while many Hydro employees and retirees are already involved in education, she hopes more will do so.

In an increasingly competitive global economy, she says, better education is the key to prosperity.

Nathoo says business and industry are facing huge challenges in the years ahead.

"One of the most disturbing trends in Canadian education is the high dropout rate," she said.

"Thirty per cent of students entering Grade 9 do not complete high school."

A breakdown of this statistic shows that Canada does not compare well with its competitor nations.

"Only 72 per cent of our 17-year-olds are still enrolled in some education or apprenticeship program," Nathoo points out, "compared with 89 per cent in Germany and 94 per cent in Japan."

By international standards, the quality of Canadian education also is poor, as shown in recent tests of secondary school mathematics. Canadians ranked a low 11th out of 13 nations surveyed. At an even more fundamental level of achievement, Nathoo continues, one out of five Canadians is illiterate.

"These statistics are frightening because Canada's future economic, industrial and technological standing hinges on the success of its educational systems."

In addition, enrolment in maths and sciences is declining — at the

EDUCATIONAL C2

The Times Colonist (Victoria, B.C.)
APR. 15. 1991

EDUCATIONAL Continued from C1

very time marketplace demand for these disciplines is increasing, Nathoo says.

"Critical labor shortages are predicted in engineering, trades and technology by the year 2000."

Given Hydro's employment profiles, Nathoo explains, it's obvious these trends are of great concern — and must be creatively counteracted.

That's why, says Nathoo, through Partners in Education, we have launched a number of projects to encourage students' interest in maths and science, and to support increased post-secondary enrolment in engineering, computer sciences, electronics and the trades, and to turn around the poor representation of women and minorities in science and technology.

Andrew Cole, Power Smart education manager, says the aim of the Power Smart education program is to instil in students a conservation ethic based on the value of energy and the consequences of wasting it.

"We provide *Energy Education Materials for Primary Students* to elementary schools," says Cole, "which helps teachers introduce students to concepts of energy and conservation."

In addition, Hydro has funded the printing and distribution of an environmental primer, *Good Planets Are Hard to Find!*, for grades 5, 6 and 7 classes.

New projects geared to secondary school students include revision of the "Energy Resource Map of B.C." and accompanying teacher's guidebook, and the development of a Power Smart "speakers' bureau."

An innovative part of Hydro's Partners in Education program is a pilot project called "Adopt-a-School," in which Hydro volunteers and a selected school form a partnership to the mutual benefit of both.

Laura Marcellus, employment equity co-ordinator, oversees the project.

"We want to promote the safe use of electrical energy, the Power Smart message and the environmental conservation message to students," she says. "We also want to make sure students develop the skills we need in the future workforce."

Hydro is revising its secondary school electrical-safety program and continuing its successful elementary school program featuring Louie the Lightning Bug, Hydro's safety mascot. The elementary school program is shown to about 55,000 students a year in grades 3, 4 and 5.

The Times Colonist (Victoria, B.C.)

APR 15 1991

Roadster of future displayed at forum

If electric cars are the way of the future, the future has arrived for the B.C. government in Victoria in the form of a silver, two-seat Comutacar, purchased this month as a delivery vehicle.

The car, which will be on display at the Conference Centre at the 4th annual Electric Forum starting Tuesday, is an experiment to explore the possibility of widespread government use of electric cars.

"We know an awful lot of electric cars are going to be produced before the end of this century and we want to be on top of the movement," says Michael Masson, environmental technician with B.C. Buildings Corporation and the chief mover behind the purchase.

He says the car will be carefully monitored for the amount of time it is used, maintenance costs and electrical consumption.

Manufactured by Commuter Vehicles Inc. in Florida, the car plugs into a conventional 120-volt outlet and has a General Electric motor with a body constructed mostly of aluminum.

In a recent talk to Hydro employees, Yakout Mansour, manager of power engineering at Powertech's laboratory in Surrey, said British Columbians can expect to see fleets of electric cars in the Lower Mainland by the late 1990s. (Powertech is one of several B.C. Hydro subsidiaries.)

He pointed out that the City of Los Angeles, for example, has already ordered 10,000 vehicles for its own fleet, to be delivered by 1994.

"An electric car is far more simple that the current internal combustion engine," he said. "It has no spark plugs, ignition system, cooling system, muffler or timing gear. It is quiet, eliminates most traffic noise and, most important, is 97 per cent less polluting than gasoline-fuelled vehicles."

He said the technology for the electric car exists; and it is just a matter of time before it is refined, especially in the development of efficient and compact batteries.

"The development could be speeded up," he said, "if demand for volume is there. What an effect there would be if more than a million people signed up for environmentally friendly electric cars.

"Imagine: Electric energy generated by hydroelectric or other environmentally clean alternatives, transmitted using new technologies which utilize existing rights-of-way, and used to drive electric cars with virtually no pollution!"

APR 15 1991

Forum explores energy

Exciting new program includes youth events, Power Smart displays

THE 4TH ANNUAL electric energy forum starting this Tuesday at the Conference Centre includes some exciting new events which will expand its scope beyond that of its predecessors.

As in previous forums, there will be presentations, panel discussions and group discussion workshops. In addition, there will be separate events and exhibits encouraging participation in a wide range of activities for everyone, from tots to seniors.

"We have many youth-centred activities because education has been included in this year's theme, which is *Electricity, Education and the Environment*," says Hydro's Conrad Guelke, organizer of the event. "But we also have a Power Smart exhibition which will give homeowners and other visitors some practical ideas on the wise use of energy."

He says the prime purpose of this forum, as in previous ones, is to obtain input from participants on energy use.

At the session of Science World's travelling Show Team of Science, children will be asked to try their hand at making a rainbow, creating a sunset in a bottle, shrinking a marshmallow or levitating a beach ball. In a light-hearted event called Design Challenge, students from school districts on the Island will find solutions to scientific challenges.

"We're trying to expose young people to the fun side of science," says Wayne Cousins, the Hydro organiser of Design Challenge. "Science is fascinating — not dull and monotonous."

In a colorful and diverse presentation on Wednesday evening, the Pearson College International Choir and Folk Dancers will entertain delegates with dances and songs from countries as different as Sweden, South Africa and Argentina.

As well as displays of practical, energy-saving devices for the home, the Power Smart exhibition includes demonstrations of electric vehicles, displays on electrical safety and environmental protection, and live presentations of Shell Busey's Home Ideas Show.

Sponsored jointly by B.C. Hydro and the provincial government, the forum will focus on how society can prepare itself, through public education, for a world where energy conservation and environmental awareness will determine how future electricity needs are met.

Registration and payment are necessary to attend the formal part of the forum. Interested members of the public may register at the door, beginning at 6 p.m. Tuesday and throughout the forum. Further information can be obtained from Connections Victoria at 383-6332, or from the Forum Hotline at 1-663-3389 in Vancouver.

The registration fee depends on how much of the three-day conference one wants to attend. Admittance for the full three-day program is $200; $30 would cover the opening session and the reception which follows.

■ HOCKING: UVic professor to speak

David Strong, president of the University of Victoria, will accept a Power Smart plaque at the opening ceremonies of the forum. The University of Victoria is a Power Smart participant.

Frank King, former chief executive of the Calgary Olympics, will deliver the keynote address on Tuesday at 7:15 p.m.

Other forum speakers will include Janet Halliwell, chairman of the Science Council of Canada; Martin Hocking, professor of chemistry at the University of Victoria; Lon Mandrake, past president of the B.C. Teachers' Federation, and ministers of sponsoring provincial ministries.

The Times Colonist (Victoria, B.C.)

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Students get chance to strut their creativity

B.C. students have a chance to demonstrate their scientific and technical creativity at the Energy Forum beginning Tuesday at the Conference Centre adjoining the Empress Hotel.

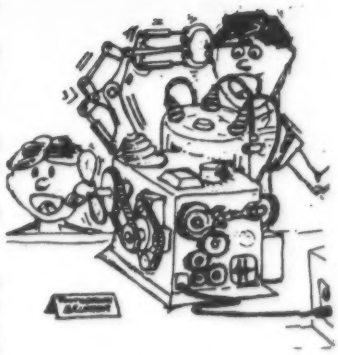
Teams of students in grades 6, 7, 8 and 9 from schools in the southern Vancouver Island region will participate in Design Challenge, a lighthearted B.C. Hydro-sponsored event in which students are asked to find solutions to scientific challenges.

"Too many students see science as dreary and monotonous," says Wayne Cousins, the B.C. Hydro organizer of the event. "This event is an attempt to expose students to the fun side of science."

He says the Design Challenge concept was created to present science in a positive light and foster innovation, creative problem-solving and invention.

A Design Challenge event may range from a half-hour classroom activity to a full day of activities. An activity may involve constructing a model or device using a prescribed set of materials, solving a chemistry or biology problem in a limited amount of time or creating a dance, song or poster to illustrate a scientific concept.

Team and individual awards will be presented to winners.



■ TOOTPBRUSH brusher!?

The Times Colonist (Victoria, B.C.)

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Kindergarten crowd learns maths, science can be fun

B.C.'s Ministry of Energy, B.C. Hydro and a science education association have joined forces to develop an energy education program aimed at students from kindergarten to Grade 7.

Preliminary response from students has been good. "I liked it when we got to get into groups to do commercials about saving energy and the environment," said Kim Thomas of Thomas Kidd Elementary School in Richmond.

"We want to encourage a high level of learning, especially in the areas of maths and sciences, to enable today's students to compete and excel in tomorrow's workplace," said Barb West, co-ordinator of B.C. Hydro's Partners in Education program.

Educators have applauded the "learner-focused" design of the program, whih emphasizes the fun of hands-on participation.

One component of the program provides children with the opportunity to interact with energy sources such as steam generators, hand-powered generators, chemical energy lights, and wind-up toys. Learning is also achieved through role playing, skits, puzzles and games.

The theme of the program is energy efficiency — with the focus on energy sources, daily energy use and the relationship between energy and the environment.

The program — including input from the Association for the Promotion and Advancement of Science Education — is intended to teach students the importance of energy to British Columbians as well as the "life cycle" and the environmental impacts of major energy resources from their development, use and disposal.

It also takes a look at alternate forms of energy and illustrates how individuals can undertake their own energy-efficiency measures.

Development and field testing of the program are complete. The Ministry of the Environment wll co-ordinate program delivery through their environment education program and Environmental Youth Corps.

Rebates aim to sway fridge buyers

B.C. Hydro's Power Smart campaign is going all out to make the most energy-efficient fridges the premier choice for buyers in B.C.

Now it's offering $65 rebates on models that are 10 per cent more efficient than standard Power Smart ones.

It is reducing the $50 rebate to $40 for standard Power Smart fridges.

"We're deliberately going all out to influence the buying pattern of British Columbians who purchase between 50,000 and 60,000 new fridges a year," said fridge program manager Cynthia Lee.

"Currently models rated as being Power Smart cost just the same as non-Power Smart ones, but now we're going to make the most efficient models irresistible for purchasers so that they become the number one choice and eventually take over the market," Lee said.

She said prior to Power Smart only a handful of fridge models were Power Smart.

"Now there are over 250 different models for sale in B.C. Power Smart dominates the retail market. Between 70 and 75 per cent of all new sales are Power Smart ones."

"We're making it easy for purchasers, too," Lee added. "Fridges qualifying for the $40 rebate will be on a yellow list available at retailers and the $65-rebate models will be on a pink list. Qualifying models will have

Power Smart's the route to go

Power Smart stickers on them to remove any confusion that may exist with customers who believe the EnerGuide label is a symbol of energy-efficiency."

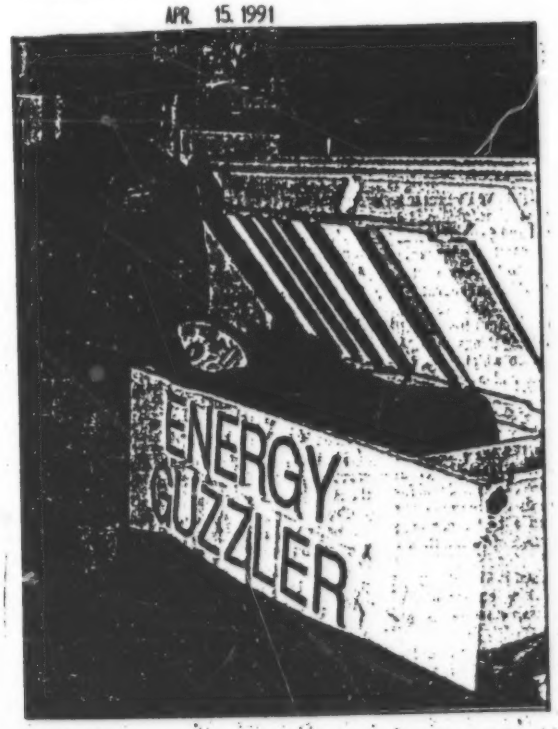
Regular Power Smart fridges save about $300 in energy costs over their 20-year lifespan and the most efficient ones, on the pink list, will save about $450.

The Power Smart fridge program aims to be providing annual energy savings of 167 million kilowatt hours by the year 2010 — enough power to meet the energy needs of 16,700 new B.C. homes.

B.C. Hydro has a handy appliance guide that tells you at a glance the operating costs of various appliances. For more information on choosing energy-efficient appliances, call the Power Smart line: 1-800-663-0431.

The Times Colonist (Victoria, B.C.)

APR 15 1991



NO ONE MOURNS at Hydro when it comes to energy savings. Victoria marketing rep Lynne Mace hams it up with widow's veil as she bids farewell to energy-guzzling fridge.

COUNCIL ADOPTS 1991 POWER PLAN *(Continued)*

Council Chair Jim Goller of Idaho said that carbon dioxide mitigation would be too big a step to take without any public discussion, but Duncan noted that the step would be a direct response to the chorus of comments calling for actions to reduce (or at least stem the increase of) emissions of greenhouse gases. Language calling for investigation of carbon dioxide mitigation approaches was ultimately adopted. In support of such investigation, Councilmember Tom Trulove of Washington said "It's really an important question that needs studying." And in an unprecedented if unwitting display of support for the notion that it is better to prevent pollution than clean it up after the fact, Councilmember John Brenden of Montana said simply, "I hate the word mitigation."

Regulatory Reform

In the regulatory arena, the Council clarified and strengthened its call for regulatory reform to "decouple" investor-owned utilities' profits from their sales and "regulatory actions that provide positive incentives for aggressive conservation actions." The final plan will also call for a "review of regulatory practicies to facilitate the siting and aquisition of generating resources included in this plan...The Council recommended that utilities receive appropriate rate treatment for...activities that reduce resource lead time and increase flexibility."

With a plan in place that calls on the region to acquire conservation on a much grander scale than it ever has, the focus now shifts to implementation. Expressing a new determination to do more than plan, the Council writes in the section of the plan on Council actions, "We intend to lead the region in promoting and implementing this power plan." The training exercise is over. Now the real work begins.

B.C. HYDRO DISCUSSES ENERGY, EDUCATION AND THE ENVIRONMENT

The Fourth Annual B.C. Hydro Electric Energy Forum on Energy, Education and the Environment advertised itself as a conference to examine ways to foster energy conservation and energy awareness through public education. But while many of the speakers were long on descriptions of environmental and educational catastrophes, they were short on visionary solutions. Notably absent from the conference agenda were environmentalists.

The stage for the conference was set by the keynote speaker, Frank King, the CEO of Metropolitan Investment Corporation and noted speaker on a seemingly incongruous range of fields, such as motivation, business, sport and environmental awareness. King requested the audience to ask itself "If the Earth had only 10 years left, what would you do differently?" He proceeded to outline countless testimonies to environmental destruction, from tropical deforestation to global warming and air and water pollution, and concluded that an environmental utopia can be achieved only through a collective change in attitude. "You must learn to love the world more than you love yourself," he said. "If you want to save the world, you must change your attitudes."

King argued for changed attitudes, but not changed behavior. He admitted he knew of no way to get people to stop relying on automobiles for transportation and questioned the necessity for changes in lifestyle. "People wouldn't accept that," he said. When asked whether people need to be involved equally in decision-making in order to achieve his utopian vision, he replied "no." "Unless you are talking about involving the people in this room, I'd have to say 'no'," he said. He explained that many people, such as starving children in other nations, are affected by the decisions made by experts, but he couldn't envision involving them.

The Role of Technology and Education

Janet Halliwell, the recently appointed Chair to the Science Council of Canada, lobbied for an increased emphasis on science and technology in a movement toward a "conserver society." She rejected the audiences' suggestions that perhaps science and technology led to environmental destruction, and therefore should be distrusted in a move toward a sustainable society. "We should not see this movement as a disdain toward science and technology," she said. "Instead we should see science and technology as part of the solution." She called nuclear fission "an absolutely essential source of energy supply and increasingly important" and renewable resources, "a technological and economic challenge."

Halliwell painted a bleak picture of the energy future. With a three percent population growth-rate, by the middle of the next century the world's energy demand will increase by ten-fold. This is aggravated by the fact that in the next 30 to 40 years there will be no more oil, she said. To meet these challenges of the future, she called for educating students to handle "systems" problems, making science accessible to the public and creating a global consciousness.

Lon Mandrake, a science and math teacher at Seaquam Secondary School in Delta, B.C., was chosen to address the question: How do you bring science to life in education? His answer emphasized the teacher's responsibility. He argued teachers must show how science fits into daily life as a "dynamic human endeavor", and said that teachers should use creative educational skills that address the educational needs of all students. Mandrake referenced startling statistics, such as, interest in science peaks when a child is in the 3rd grade and that 80 percent of grade 12 students believe in astrology.

Tazeem Nathoo, manager of B.C. Hydro's Employment and Human Resource Planning department, explained how the utility is responding to employment challenges and building its own workforce. Although Canada spends more on education than any other nation except Sweden, Canada is dropping in many educational evaluations. "Most developed nations are lacking workers," she said. "Particularly in the area of science and technology." B.C. Hydro, she explained, will need to replace nearly 1000 workers in the next decade. Therefore, B.C. Hydro has developed partnerships with schools in the province to urge students to finish high school, to acquaint them with B.C. Hydro employment opportunities, and to develop students with the "skills, knowledge and attitudes" necessary for this kind of employment. B.C. Hydro has developed mentoring programs with schools and is offering several $1000 scholarships to promising college students.

Further, B.C. Hydro has been improving its efforts in recruiting and promoting women, she said. Three years ago, women constituted 3 to 4 percent of the people in management positions at the utility. Now they represent 6 to 9 percent. Last year, the number of women engineers they recruited to the utility equalled the number of male engineers. The utility has a job share program and is developing on-site daycare.

(Continued on next page.)

B.C. HYDRO DISCUSSES ENERGY, EDUCATION, ENVIRONMENT *(Cont.)*

Derek Henriques, a manger of the energy management division of B.C. Hydro, outlined the utility's conservation, or "Power Smart" program. He announced that the utility named conservation as its Number One resource option—a significant move given that British Columbia citizens are one of the world's largest energy consumers groups, more the rest of Canada or U.S.. He explained that B.C. Hydro was encouraging conservation through (1) technological advancement, (2) economic changes and incentives, such as rewards and changes in rate structure, (3) political influence, and (4) education to change attitudes. B.C. Hydro is applying to change its rate structure to encourage conservation.

EMF: Fact or Fiction?

Leonard Sagan of the Electric Power Research Institute addressed the controversial subject of electromagnetic fields and the public's response to a cancer threat from power lines. He explained that the public is ill-equipped to judge public health issues and attributed "cancer scares" to media hype and the scientists' inability to and lack of interest in communicating clearly to the public. He gave the audience three guidelines for judging the validity of public health threats: (1) Is the epidemiological evidence sound? (2) Are there laboratory findings? and (3) Is there a possible mechanism to explain the health threat? Using these guidelines, Sagan illustrated that the evidence to link electromagnetic fields to cancer is scarce. In fact, he rated knowledge of EMF health effects at a "2" on a scale of 1 to 10, ("1" being ignorance and "10" being perfect knowledge.)

Most studies to date on EMF are epidemiological. No laboratory studies on rats have been completed, although tests are underway in Quebec and Sweden and at EPRI. Tests have failed to demonstrate that EMF mutates cells, therefore, if EMF causes cancer, the mechanism must be an unusual one. Scientists have yet to agree how an additional 1% of electric activity introduced into the incredibly electrically active environment of living cells could induce cancer, he said.

Paper Cups and Electric Cars

In a thinly-veiled assault on conventional environmental dogma, Martin Hocking explained how polystyrene foam cups are just as environmentally sound as paper cups. Hocking, a professor of chemistry at the University of Victoria, based his well-documented conclusion on a number of factors, such as a single paper cup requires ten times as much salt and sulphur dioxide as a syrofoam cup. Also, a paper cup requires 1 kg of water and 0.2 kg of organochlorines whereas a syrofoam cup requires only 4 mg of water and no organochlorines. Petroleum use is about similar for the two products because of the enourmous fuel requirements involved in harvesting wood for paper cups. In similar yet preliminary studies, Hocking is concluding that plastic grocery bags are more environmentally sound than paper, and galvanized steel trash cans are "greener" than plastic ones.

Councilman Henry Morgan of Covina, representing the Eastern Region of Los Angeles County, argued, "We are on the road to the electric vehicle." Morgan enthusiastically endorsed electric cars, 40,000 of which are used in Los Angeles, but deferred all questions about "where the power would come from" to run them to Southern California Edison. He said he heard that the California utility thought "it would be a great idea that people would be using more power" and that power transfers from outside the L.A. basin, maybe from the Bonneville Power Administration, would be available. He admitted that electric cars would do little to answer L.A.'s traffic congestion, land-use and noise pollution problems, but said that public transit would be encouraged too. He cautioned, however, that "to take people and move them to public transit will be a very long and difficult project."

The conference was held on April 16, 17 and 18 in Victoria, B.C. and sponsored by B.C. Hydro and the Province of British Columbia.

THE INSTITUTE 345 E. 47th St., New York, N.Y. 10017

Zinc-air battery powers best car

Four zinc-air battery stacks containing 33 cells each powered the winning electric vehicle at the First Annual Solar and Electric 500 auto race, held in April in Phoenix, Ariz.

During qualification runs on the first day of the event, the vehicle set a new record for electric vehicles by maintaining an average speed of 111.75 km/h (69.436 mi/h) for a one-mile run, as claimed by the Solar and Electric Racing Association (SERA)—the race's sponsors. On the second day, the car set another record by traveling one mile (1.609 km) in 51.846 seconds, before completing 174 km in 2 hours to easily win the race by four laps.

The winning vehicle, a 1991 Honda CRX, was sponsored by Southern California Edison Co. (SCE), Rosemead, Calif., and Arizona Public Service (APS), Phoenix, Ariz., and was designed by Dreisbach ElectroMotive Inc. (DEMI) of Santa Barbara, Calif. It was the only one of the 13 cars in the race with a zinc-air battery.

Batteries used by the 12 other contestants included lead-acid, lithium-air, and silver-zinc. Each zinc-air battery carries up to eight times the energy of these others of comparable weight (approximately 340 kg) and has the highest energy density per volume or weight of any battery.

"This win means that, for the first time, electric vehicles have approached the performance of gasoline-powered vehicles," said Joe McGuirk, APS manager of research.

The winning vehicle can travel 65 km at 48 km/h after a 12-minute flash charge and 160 km after a 1-hour charge. An overnight charge is required for full capacity—280 km at a nominal speed of 90 km/h.

The zinc-air car battery can deliver 400 A at 125 V, or 50 kW. In a typical suburban drive, the vehicle consumes 6–10 kW.

Oxygen from the air is the active cathode material in a zinc-air battery. The anode consists of an amalgam of powdered zinc mixed with a gelling agent to keep it uniform during discharge. The electrolyte is a water-based solution containing potassium hydroxide and a small amount of zinc oxide. Once a zinc-air battery is placed in a closed circuit, the oxygen combines with the zinc mixture and current flows.

Ancient history

The zinc-air car battery is a new rechargeable version of the zinc-air battery couple, which has been in limited use for about 50 years. According to DEMI, the newer batteries could ultimately yield vehicle ranges up to 500 km on a single charge.

Zinc-air batteries were commercialized in 1982, and are mainly used for hearing aids, pagers, medical monitoring instruments, and other frequently used devices. Only recently have they been tested as the power source for electric vehicles.

Currently, the few commercially available electric vehicles utilize lead-acid batteries, which contain a small fraction of the energy content of gasoline by weight and, therefore, yield very short vehicle ranges.

In a demonstration this year, DEMI used 200 zinc-air cells to power a Plymouth Voyager minivan for 359 km on a single charge, setting a new long-distance record for electric minivans. The manufacturer also uses a zinc-air battery to power its DEMI X-1, an electric vehicle that in one mile can reach a maximum speed of 238.0 km/h from a standing start.

As more states continue to enact legislation limiting the use of hydrocarbon-fueled vehicles, the future of the zinc-air car battery looks promising. An example is California, which has mandated that by 1998 2 percent of all new vehicles sold in the state must be electric and by 2003, 10 percent, or 500 000 electric vehicles, must be in use there.

—George Likourezos